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EDITORIALS

SURFACE BRIGHTNESS.

The growing recognition which is being given by the illuminating engineer to the importance of the brightness of surfaces in the field of vision, whether those surfaces are sources or are illuminated objects, is attested by the number of papers presented at the recent annual convention of the Illuminating Engineering Society in which this element is given prominence. Two of the papers, those by Dr. L. T. Troland and Dr. P. G. Nutting, were primarily concerned with this subject. Dr. Troland considered the subject from a general physiological and psychological point of view. Dr. Nutting gave experimental data on threshold, contrast and glare sensibility over the entire visual range of intensities. Important relations were found. For instance, the logarithm of glare was found to bear a linear relation to the logarithm of intensity of field, glare being here taken as the ratio of the least intensity of light which produces discomfort to the intensity for which the eye is adapted. Also, the ratio of the brightness of the field to the least change in brightness which can be detected, was found to be approximately constant through a range of field brightness from a millilambert to a lambert. This ratio is called by Dr. Nutting the "discrimination-factor."

The paper by Dr. Ferree and Dr. Rand continued the study of the effect upon ocular fatigue of lighting installations using different forms of reflectors, giving particular attention to surface brightness as the chief variable. These tests confirmed previous results to the effect that severe contrasts in brightness in the field of view are not conducive to the maintenance of a high degree of eye efficiency.

A paper by Professor Caldwell recorded the effect of the presence in the field of view of a bright source upon the observer's judgment of the intensity of illumination. While different observers were not at all uniform in their judgment, there was a well defined tendency to consider the illumination brighter when the source was in the field than when the same intensity was supplied by indirect means. Perhaps different interpretations can be put upon experiments of this kind, but they would seem to indicate that the surrounding field influences the judgment as to apparent brightness. Since no tests were conducted upon ability to see, no conclusions can be drawn as to the relative intensities which would be required to see equally well under direct and indirect lighting equipments.

THE RELATION OF CENTRAL-STATION RATES TO MUNICIPAL OWNERSHIP.

The aim of central-station companies in fixing a schedule of rates for residential service has usually been to combine fair treatment of individual customers and a fair return to the company with simplicity of form and readiness of understanding by the customer. These aims conflict to some extent. The latter are realized most perfectly in a straight meter rate. The former involve, on the other hand, either a differential rate, a minimum bill, a demand charge or some combination of these with perhaps even further complications. It is still an open question as to which of these is to be preferred when all things are considered and the decision is often influenced by local conditions, local public sentiment or expediency.

The leaders in the industry and the committees of the national associations have usually given the preference to a differential rate, with a low secondary or tertiary rate, which would encourage the use of current-consuming household devices, while at the same time insuring to the company an income from the primary rate which would take the place of a demand or service charge. While this is probably the most equitable rate that can be used without greater complication, there are often reasons based upon expediency which favor a different form. One of these is the effect upon the sentiment in the community for a municipally owned plant, as pointed out in an article in this issue by Mr. Glenn Marston. It is quite true, as brought out by Mr. Marston, that public opinion frequently judges rates by reference to and comparisons between the maximum or primary rate, without going deeply enough into the question to consider what the monthly bill of the average residence consumer may be, or what the total income of the central-station company is from this class of consumer. In other words, it is often the appearance rather than the substance that influences public opinion in this matter, and this is a question which may receive serious consideration in coming to any conclusion upon this matter. Another point for serious consideration is the relative merits of a service charge and a minimum bill.

The subject of rates is one of the most vital subjects affecting agitations for municipal ownership of electric light and power plants. It is not, however, by any means the only element which influences the public in passing upon this question. In future issues Mr. Marston will consider a number of other elements which have an important bearing upon this subject, and which should be well considered by electric companies, not

merely after agitations for municipal ownership are started but at all times, so that the start can be entirely avoided. One objection to municipal ownership which exists in some states, and which is not always considered, is the necessity of restricting the operations of a municipal plant to municipal territory, with respect both to the supply of consumers and access to sources of power such as water falls. Private companies frequently find it desirable to extend transmission systems over state lines and to consolidate the generation and distribution of electric energy for serving large territories. This is frequently not feasible under municipal ownership.

OPPORTUNITIES OF THE ELECTRICAL ENGINEER.

So much emphasis has been laid of late upon the commercial aspects of electrical work that a good many people have jumped to the conclusion that very few opportunities lie ahead of the purely technical man, in comparison with the outlook of his brother in the so-called business side of the industry. It is true that commercial problems bulk large at the present time, and it is a good thing that this is so, for insufficient emphasis was laid upon this phase of electrical development for decades associated with the pioneer stages of the art. Plenty of us can remember when the inauguration of a "new-business" department in a central station represented an almost revolutionary change in the policy of a conservative company. Nowadays energetic sales effort is taken for granted as an absolute essential of central-station advance, and it is amusing to recall the hostility of some of the early managers toward advertising appropriations, house-to-house campaigns, and other concomitants of modern commercial propaganda.

The broadening of the electrical field from the inventive to the applied territory covered today has opened opportunities for men of varied talents and tastes which did not exist relatively few years ago. We no longer have the one-sided development of the past, in which the problems of energy production attracted the maximum attention, while those of the customer were often left to shift for themselves. But it would be a great mistake to assume that practice and design have become so standardized in the engineering side of electrical development that few opportunities remain for technical genius and even for sustained, plodding effort to accomplish results which may prove to be momentous in their effects. For men with aptitude toward the technical side of the industry great opportunities still exist. The work of the research laboratories of the great electrical manufacturers is a constant refutation of the contention that everything in the purely technical field of electrical development has become cut and dried.

The list of unsolved problems centering about the production of more efficient illumination would easily fill a page. The possibilities of electrochemistry are simply profound in their scope, and even in the time-honored field of power-plant work, a long advance toward really high efficiency of production in relation to the heat content of coal is open to the engineer. The engineering experiment stations of the colleges are becoming more and more useful in practical research, and in the field of communication we have only begun to chart the possibilities of radio. A look across the Atlantic suffices to convince one that the impetus toward scientific progress rendered by military necessities is sure to be reflected in part at least by corresponding achievements in the works of peace, for developments have been forced without regard to cost and consequently much has been learned that might have taken decades of casual research without the stimulus of war. Deplorable as the conflict is, there are some by-products of war which will yield lasting good to the human race, notably in the fields of surgery, sanitation, aviation, communication and manufacture. Both the technical man and the commercial man are needed as electrical progress is realized, and in the field of each the reward of ability plus industry is sure to come.

IMPROVED STREET LIGHTING BY SPECIAL ASSESSMENT.

After the movement for ornamental street lighting began to make headway nearly ten years ago it was shown that the immediate benefits were chiefly twofold, namely, greater business for the merchants along the street whose lighting had been improved, and increased property value for all owners of real estate on the street. Realization of these commercial benefits therefore greatly stimulated the movement, which soon spread throughout the country so that today there are practically no progressive cities or even towns that do not have one or more business streets along portions of which more or less ornamental lighting has been provided.

City governments, as a rule, are conservative and slow to take up new ideas. Consequently the less direct benefits of ornamental street lighting to the community at large were not readily recognized and therefore the tenants and owners of property along the streets that sought improved lighting were almost invariably left to pay for the cost of providing and maintaining it. In many cases this was assumed with commendable public spirit by all of the interests affected, thus producing many admirable examples of ornamental street lighting carried on according to a pleasing and uniform plan throughout the street. In a great many more cases, however, there was a small and close-fisted minority who professed inability to see any immediate benefit and who therefore refused to contribute to the desired betterment. This resulted in the custom of providing the ornamental lighting in front of the premises of those only who had contributed to the installation. Such a

non-uniform system largely defeats the primary objects of the improved lighting. It certainly is not particularly esthetic and, where the gaps or dark spots along the street are numerous, it keeps many people from passing on the street who would be attracted by uniformly bright illumination.

It has been seen for some time that there was needed some definite method for overcoming these hindrances to projects for improved lighting. Those who gave the subject much thought felt that the most logical and equitable way was to treat improvement in street lighting in the same manner as any other special improvements along a street are treated in our laws. For instance, it is the common practice to pay for paving, sewer construction, and other similar improvements by means of special assessments that are levied uniformly on the property which derivers immediate benefit from these betterments. As soon as improved street lighting is recognized as being a similar improvement, a logical way for paying its cost is evidently by special assessment.

In two states, at least, this plan has worked out, as was recorded in the answer submitted by Mr. L. M. Klauber, of San Diego, and published in the Questions and Answers Department in our last issue; the procedure in California was there described. In the current issue is published an answer from Mr. Bayard W. Mendenhall, of Salt Lake City, who briefly describes the procedure in the state of Utah and the excellent results it has produced. A forcible example thereof is the splendid lighting of Main Street in Salt Lake City, which was inaugurated a week ago and is described in this issue.

It is evident that through a special-assessment plan it is possible to carry out an improvement of this character, even over the protests of a small minority who otherwise would either entirely defeat the project, or who would spoil the effect desired; and the plan provides, moreover, for installing a much more elaborate and satisfactory system than would be possible where individual private initiative is depended upon entirely. Another advantage of the specal-assessment method is that the community usually contributes a portion at least of the entire expense, this corresponding to the cost of maintaining the system then in vogue. By this means there is provided one uniform system throughout the street affected, instead of the common and unsatisfactory method of having one city system and an independent system installed by the property owners or merchants.

There is no doubt that many fine installations of ornamental street lighting can be provided by full cooperation of improvement associations and the city, as is referred to in this issue in the case of Monroe Street, Chicago, and Market Street, San Francisco. However, these installations could likewise be provided by special assessment and no doubt in a more expeditious and complete manner, besides insuring that the cost thereof is spread equitably among all the interests benefited.

EFFICIENCY IN THE PRODUCTION OF LIGHT.

The enormous improvements which have taken place in the electric incandescent lamp in the past ten years might lead the unthinking to anticipate equal gains in the future. We now get about eight times as much light from the most efficient gas-filled lamps as was obtained from the same wattage when using a carbon filament. That no such advances can be expected in the future was made plain by Dr. C. P. Steinmetz in his recent presidential address to the Illumination Engineering Society. Slight improvements are of course to be looked for. The substitution for nitrogen of a gas with lower specific heat will make some improvement. This has already been accomplished in the use of argon. The use of higher pressures might also assist. This has already been investigated experimentally. A lamp has recently been patented abroad using an inner inclosure of glass around the filament in which mercury vapor is maintained at a higher temperature and pressure. But none of these devices can do more than add slight increments to the present efficiency of transformation of the electrical energy into useful light.

Even if a satisfactory arrangement for operating tungsten at its melting temperature could be devised, the light obtained per watt would be not more than double the amount secured at present in gas-filled lamps. The only element known which has a higher melting point than tungsten is carbon, and it has been found inferior to that metal in efficiency under practical operating conditions. A metal may some day be discovered with a higher melting point than tungsten, and chemical theory points to the existence of just one such element, at present undiscovered. The fact that it has not yet been discovered would indicate that it is not plentiful in the earth's crust, and hence would never be available in large quantities. Such conclusions are not always valid, however, for argon, which constitutes about one per cent of the atmosphere, remained unknown until recent years. Even though the unknown element be rare, it is quite possible that its addition to tungsten in small percentages would raise the melting point of the latter and reduce the vapor pressure at the operating temperature.

In a paper presented before the American Electrochemical Society last week, Mr. F. A. Fahrenwald suggests that such a result may be obtained by a combination with tungsten of some metal already known, such as osmium or tantalum. It is not likely, however, that such a metallic compound has escaped the keen search of the manufacturers.

Dr. Steinmetz finds the greatest possibilities for higher efficiencies in light production in the phenomena of electro-luminescence, but the pathway to realization is very obscure and difficulties are to be surmounted which at present seem unconquerable. Greater probabilities of advance exist in the luminous type of electric arc, according to Dr. Steinmetz, and it is in this field of endeavor that success seems most likely to crown the brow of the investigator of high efficiencies in light production.

An Analysis of Electric Cooking

A Comprehensive and Original Article on Electric Cooking Which Will Be Published in Two Parts in the Issues of October 14 and 21 Respectively

By H. O. SWOBODA
Consulting Electrical Engineer

ALTHOUGH there has been much written on the subject of electric cooking there has, nevertheless, been felt for some time the need for a comprehensive analysis of the whole question so that a central-station company could determine with some degree of intelligence just what electric cooking would mean in the way of development expense, what the characteristics of the load would be and just how far it is advisable to go in the matter of special electric cooking rates.

Starting with the issue of October 14, we will publish an article in two parts by Mr. H. O. Swoboda, consulting electrical engineer, Pittsburgh, Pa., which will furnish authentic data from which answers to the above questions can be derived. The development of the art of electric cooking is described fully and this is followed by a comprehensive tabulation of central-station cooking rates now in effect, pointing out the date established, minimum monthly payment, discount, whether or not a separate meter is used, price per kilowatt-hour and the existing gas rate. Actual energy consumption and costs are compiled from innumerable tests in this country and elsewhere and from a large number of typical installations in residences, clubs, hotels, aboard steamships, etc. Under the heading of "Miscellaneous Data" the author makes an engineering comparison between gas and electric cooking, giving data on temperatures, shrinkages, heat units required, etc.

The article is accompanied by 22 tables, giving the following data:

Table No. 1—Domestic rates for electrical energy for cooking in 80 cities.

Table No. 2—Population of cities enumerated in Table No. 1.

Table No. 3—Dates on which rates in Table No. 1 were established.

Table No. 4—Minimum-payment protion of cooking rate.

Table No. 5—Charges for the purchase of 100, 200 and 500 kilowatt-hours per month.

Table No. 6—Charges for the purchase of 100, 200 and 500 kilowatt-hours per month.

Table No. 7—Connected load, maximum demand and diversity-factor for domestic ranges.

Table No. 8—Connected load, maximum demand and diversity-factor for large kitchens.

Table No. 9—Energy consumption in domestic cooking in the United States and Canada.

Table No. 10—Energy consumption in domestic cooking in England.

Table No. 11—Energy consumption in domestic cooking in Germany and Switzerland.

Table No. 12—Average monthly bills for electrical energy for domestic cooking in the United States and Canada.

Table No. 13—Energy consumed by various articles of food.

Table No. 14—Comparison of efficiencies of electric ranges, individually heated cooking utensils and fireless cookers.

Table No. 15—Comparison of actual costs of fuel and electric domestic cooking based on operations extending over one year.

Table No. 16—Restaurant kitchens, serving meals all day.

Table No. 17—Large kitchens, serving large groups of persons at fixed hours.

Table No. 18—Comparison of actual costs of operating large kitchens with fuel and electricity.

Table No. 19—The temperatures applied in cooking.

Table No. 20—The shrinkage of meat.

Table No. 21—Comparison of heat units required in gas and electric cooking.

The table of central-station rates presented in Table I is compiled from data secured in direct correspondence with the 80 companies involved and presents for the first time an official statement of domestic cooking rates that have been adopted.

Happenings in the Industry

Annual Meeting of New England Electrical Contractors' Association—Elaborate Plans of Power Sales Bureau—New York Meeting of American Electrochemical Society—Property Owners Improve Lighting of Monroe Street—New Street-Lighting System for San Francisco Inaugurated—America's Electrical Week Plans—Miscellaneous News

NEW ENGLAND ELECTRICAL CONTRACTORS MEET AT HARTFORD.

Uniform Electrical Inspection, Licensing and Other Important Topics Discussed.

The third annual convention of electrical contractors of New England was held at Hartford, Conn, September 26 to 28. Sessions were held in the Governor's Foot Guard Hall, while an elaborate exhibit of appliances and fittings was displayed in the armory room of the same building. More than 150 contractors and other electrical men from the several New England states were in convention, and it was one of the most valuable of the three gatherings held thus far. The Connecticut Electrical Contractors' Association had immediate charge of affairs, the various committees being composed mainly of Connecticut men. E. M. Baldwin, of Hartford, was head of the general Convention Committee, and was to have presided, but owing to illness L. L. Gaillard, of Waterbury, occupied the chair the first day, welcoming the delegates and other visitors, in the name of the Connecticut Association. Mayor Frank A. Hagarty, of Hartford, made an address of welcome, in which he reviewed some of the many achievements of electrical science.

Robley S. Stearnes, of New Orleans, La., president of the National Electrical Contractors' Association, was the next speaker. He said the national membership is now about 1,200, and the work includes an attempt to bring about a co-operation of forces which will result in a better buying power for the contractor.

Improvement of Electrical Contracting Business Through Organization.

W. K. Tuohey, past-president of the Massachusetts Association, praised the work of the Connecticut contractors in making the two preceding conventions—at Worcester and at Springfield—successful. He said that prior to 1914, when the first convention was held, conditions in the business were absolutely chaotic. It was hard to know where to start, but a few men met and organized, with results which have been gratifying. The first and most important result was to make the contractor have faith in himself, and a new sense of the dignity and high character of his business. He came to see that his competitors were honorable men and that central-station operators were not ogres. A start was made toward legal regulation, and the law enacted in Massachusetts was a great forward step. A joint committee with central stations, and a trade relations committee, a committee on cost accounting and bookkeeping and on the National Code, have accomplished important results from mutual contact with other factors in the industry and by careful study of problems.

"Are we ready to take advantage of the opportunities?" asked Mr. Tuohey. "Must we continue to suffer from 'dog in the manger' competition from within our ranks, and unjust exactions from without?" The only answer is a close-knit organization and loyalty to it.

Mr. Tuohey advocated a Central Credit Bureau to which all overdue accounts would be reported. This would be valuable to the jobbers, and indirectly helpful to the contractors.

J. E. Wilson, special representative of the Massachusetts Association, then spoke on "The Licensing of Electrical Contractors and Operation of the Massachusetts Law." A summary of this address and the discussion of it is given in another part of this issue.

Uniform Inspection of Electrical Installations.

The afternoon session was devoted to a general consideration of the desirability of uniform electrical inspection, and brought out some very valuable suggestions, a number of fire-insurance men being present. The subject was particularly appropriate, Hartford being the leading fire-insurance center of the country.

A. J. Hixon, president of the Massachusetts Association, held that inspection should be universal, and uniform as between all localities. Every bit of electrical work should be properly approved, wherever located, and the inspectors should be trained men, familiar with all fittings and materials.

Several factors are interested in inspection: the owner of the property, manufacturers and installers, the insurance companies.

In the evening a banquet, with amusement features, was enjoyed at Hotel Bond. President Stearnes, of the National Association was toastmaster.

Reports of Conference Boards and Trade Relations Committee.

T. A. Stewart, of Hartford, presided at Thursday morning's session, when the principal work was consideration of committees appointed in 1915 to confer with other organizations of the industry.

Earl E. Whitehorne, New York, made an address on the benefits of membership in the Society for Electrical Development, urging contractors to unite with other factors in the business to make America's Electrical Week a success. The $10 membership fee will be received back many fold, said the speaker. Mr. Whitehorne described the Society's work in detail. W. F. Abely, of the Western Electric Company's Boston office, paid high tribute to the Electrical Development Society.

A report of the Trade Relations Committee, appointed at the Springfield convention last fall to promote friendship between manufacturers, distributors and installers, was presented by W. F. Abely, chairman. Several meetings have been held, and the committee believed the work should be continued another year.

W. K. Tuohey, of Springfield, criticized the report as being indefinite, and urged definite, constructive results. George J. Murphy, of the Pettingell-Andrews Company, Boston, called attention to the great difficulty of securing a clear understanding among the various interests. Mr. Tuohey urged that the jobbers form an organization with which the contractors may treat. Mr. Murphy pointed out that the principal points at issue are: (1) What qualifies men to enter the electrical business and obtain recognition from the sales department of jobbers; (2) the practice of jobbers in selling supplies to isolated plants in smaller centers; (3) the question of creating a standard in resale prices.

William P. Horne, Oak Bluffs, Mass., pointed out the discouraging competition the contractors has from five and ten-cent stores selling cheap wiring appliances and fittings. Mr. Abely, in reply, said that if contractors will go to the local inspectors they will be able to prevent the use of much of the material that is unsuitable. He believed con-

tractors could secure a larger share of the "pickup" or small-order business if they would go after it. This business is profitable.

Several contractors criticized the sale of lamps, appliances and supplies by drug stores. Mr. Murphy defended it, saying that electrical development is bound to follow lines of least economic resistance. The drug store is a most advantageous place of sale for such materials, many of which are required in emergency and quickly, and are readily procurable at such stores which are open 18 hours a day, every day in the year. Mr. Murphy said the profits of the jobbing business are modest. No jobber after allowing for expenses and overhead realizes more than 3.5 per cent net profit on sales.

It was voted to discharge the Trade Relative Committee and appoint a new one of 15 members.

A report of the Massachusetts Conference Board with Central Stations, was presented by J. E. Wilson, for H. A. Holder, of Boston, the chairman. It recommended that members of the association advise the committee in writing of the differences that arise between them and the lighting companies, these reports to be taken up and discussed with the corresponding committee of the New England Section, National Electric Light Association.

Accounting for Electrical Contractors.

The concluding session of the convention was given to a paper by Percy Rothwell, expert accountant, of Hartford, on "Account Keeping for Contractors." "The first thing to do," said Mr. Rothwell, "is to make a careful inventory of stocks. Materials are another form of money. The next important factors are time keeping and pay rolls. It is well to pay four times a month instead of weekly, as in that way no part of a pay week will go into two different months, causing confusion and extra accounting cost."

Overhead expense is the most important problem. The only satisfactory method is to figure accurately the amount of nonproductive labor, nonproductive material and selling expenses. The sum of the three should be carefully studied with the object of reducing it to a minimum.

Chairman Gaillard reported for the Connecticut Conference Board with Central Stations. He pointed out the difficulties and lack of interest heretofore encountered and said he believed better results would accrue if the Board were composed of members from various New England states, giving it a more than local character.

Amos Greene, of Westbrook, reporting for the Legislative Committee of Connecticut, said the members have been trying to establish a fee system of inspection throughout the state. The insurance interests fail to show willingness to co-operate.

Plans of Power Sales Bureau to Be Outlined at Committee Meeting.

The Power Sales Bureau of the National Electric Light Association is formulating a comprehensive plan for the year's work, the principal idea being to make the activities of the Bureau effective throughout the year. The functions of this Bureau are to develop as fully and as rapidly as possible the widest use of electricity for industrial purposes, including its use in electrochemistry, general power, industrial heating, and isolated-plant work; to provide an organization whereby this work can be carried on in such a manner as to properly co-ordinate effort and thereby minimize duplication, and to provide means for disseminating data and information in an effective manner.

One of the principal activities of the Bureau will be to collect and compile data on the various industrial applications of electricity, and to properly edit this material and place it on file at headquarters for general use. Every company will be asked to appoint a representative to be responsible for the portion of the work in its immediate territory.

The Bureau, of which George H. Jones, of the Commonwealth Edison Company, Chicago, is chairman; C. H. Stevens, of the Brooklyn Edison Company, vice-chairman, and H. E. Holding, of the Public Service Company of New Jersey, secretary, has called a meeting of the executive committee, to be held October 11 in the East. At this meeting the personnel of the various committees and subcommittees will be completed and details worked out for the year's work.

MEETING OF AMERICAN ELECTROCHEMICAL SOCIETY.

New York Meeting Held in Conjunction with American Chemical Society.

The thirtieth general meeting of the American Electrochemical Society was held in conjunction with the annual meeting of the American Chemical Society and the Second National Exposition of Chemical Industries, in New York City last week. Wednesday was Electrochemical Day at the Exposition, and the Society held the opening meeting at the Grand Central Palace, where the Exposition was being held. President F. A. J. FitzGerald had prepared an address for this occasion, but owing to illness was unable to be present, and it was read by J. A. Matthews. It was followed by a discussion upon the subject of the electric steel furnace.

Sessions for the reading of papers were held at the Hotel Astor on Thursday morning, Thursday afternoon and Friday morning. On Thursday evening there was a smoker at the hotel, and on Saturday an all-day excursion up the Hudson River.

F. A. Lidbury presided at the session on Thursday morning, which was devoted to the general subject, "Made in America." The subject was opened by Vice-president L. E. Saunders, who was followed by Acheson Smith and Edward Schramm. A general discussion then followed, which was participated in by A. T. Hinckley, Robert C. Canby, T. H. Schoepf, Allerton S. Cushman, E. A. Colby, J. W. Beckman, J. W. Richards, William C. Moore, G. A. Raush, M. B. Smith, A. S. McDaniel, E. A. Lyon, William Blum and F. C. Frary.

Vice-president Saunders presided at the other sessions. The first paper presented at the session on Thursday morning was one by O. P. Watts and P. L. DeVerter, entitled "The Protection of Iron by Electroplating." The experiments of the authors confirmed the view that the superiority of electrogalvanizing over deposits of other metals for the protection of iron is due to voltaic action. For the protection by electroplating of iron which is to be exposed to the weather, zinc is the only metal worthy of consideration. This paper was discussed by George B. Hogaboom, Carl Hering and Joseph W. Richards.

In a paper entitled "Asmospheric Corrosion of Commercial Sheet Iron," E. A. and L. T. Richardson claimed that the presence of copper in steel is advantageous in increasing resistance to corrosion, and that charcoal iron and pure iron are superior to steel in this respect. This paper was discussed by Allerton S. Cushman, D. M. Buck and James Aupperle.

S. Fischer presented a paper on "The Electrolysis of Vanadium Salts," which was discussed by W. R. Mott, W. E. Koerner, Colin G. Fink and William Blum.

A paper by L. D. Hammond, on "The Electrodeposition of Nickel," dealt with the best conditions for depositing this metal upon a zinc surface. It was discussed by George B. Hogaboom and Leonard Waldo.

F. C. Mathers and F. G. Sturdevant presented a paper en-

titled "Current Efficiencies in Nickel-Plating Baths with Rotating Cathodes." This paper showed that the impurities in nickel salts are the cause of low initial current yields. This paper was discussed by G. B. Hogaboom.

William Blum presented a paper entitled "Preliminary Studies in the Deposition of Copper in Electrotyping Baths." From a study of the tensile strength, ductility and microstructure of copper deposited upon graphited wax molds, the effects of the various conditions of deposition upon the properties of the copper were determined. This paper was discussed by Leonard Waldo, George B. Hogaboom, F. C. Frary and W. S. Tyler.

The first paper to be presented at the session on Friday was entitled "Characteristics of Small Dry Cells," by C. F. Burgess. In the absence of the author this was presented by W. B. Schulte. The paper discussed the various properties of dry cells and gave the results of tests upon the capacity of hours of service, and the durability or deterioration of cells with time when not used. The author stated low deterioration was accompanied by low capacity, and the best cell must be determined by the best combination of capacity with life.

In discussing this paper, A. T. Baldwin said that these conclusions were not substantiated by the tests, which showed that certain cells were superior to others in both of these qualities. C. A. Gillingham did not consider the capacity test applied suitable for all brands of cells, which are made with different characteristics. The author used a resistance of four ohms in discharging the cells, but a value of 2.75 ohms would be better as corresponding to the resistance of the lamps used with these cells in flashlight service. A discontinuous test would be superior to the continuous test. Carl Hering suggested that a cell might be discharged at constant wattage in the capacity test, in which case a point is reached where the discharge suddenly ceases. J. W. Richards suggested that the product of shelf life and capacity would be a good index of the relative merits of different cells.

The next paper was by L. C. Turnock, and was entitled "Effect of Temperature on the Performance of the Edison Storage Battery." The author found the operation of the battery at temperatures above 50 degrees centigrade detrimental to its life. The capacity of the positive electrode may be restored by an overcharge at a low temperature. The best efficiency is obtained by charging at low temperature and discharging at high temperature. This paper was discussed by Joseph W. Richards and F. C. Frary.

Carl Hering then presented a paper entitled "High-Temperature Heat Developed During Electrolysis." This described an experiment in which high current-density produced around a cathode in an aqueous electrolyte a film of gas across which arcing took place, producing a high temperature at the surface of the cathode. This paper was discussed by E. F. Northrup, C. G. Fink, F. C. Frary, William R. Mott, J. W. Richards, E. E. F. Creighton and F. C. Atwood.

A paper by F. A. Fahrenwald, entitled "The Possibilities of Developing Super-refractory Materials for Incandescent Lighting," was presented by G. A. Raush. The object of the author was to find some combination of metals or of their compounds which will be superior to tungsten for making incandescent-lamp filaments. He considered it possible that some such alloy might be discovered. This paper was discussed by M. G. Lloyd, W. R. Mott, James Aupperle, C. G. Fink and Carl Hering.

Other papers presented at the convention were: "Comparison of the Ionization Currents Due to Equal Quantities of Radium Emanation in Different Types of Electroscopes," by T. H. Leaming, Herman Schlundt and Julius Underwood; "A New Method for the Study of Silver Peroxynitrate," by Mortimer J. Brown; "The Equilibrium Between Bromine and Potassium Bromide Solutions at 0 Degrees," by Grinnell Jones and Miner Louis Hartmann; "The Electrolytic Recovery of Lead from Brine Leaches," by Clarence E. Sims and Oliver C. Ralston; "Electrolytic Zinc Dust," by Harry J. Morgan and Oliver C. Ralston.

Among the exhibitors at the National Exposition of Chemical Industries were the following: American Transformer Company, Newark, N. J.; Beighley Electric Company, Cleveland, O.; Bristol Company, Waterbury, Conn.; Brown Instrument Company, Philadelphia, Pa.; Condensite Company of America, Bloomfield, N. J.; Driver-Harris Wire Company, Harrison, N. J.; Thomas A. Edison, Inc., Orange, N. J.; General Bakelite Company, New York, N. Y.; General Electric Company, Schenectady, N. Y.; Great Western Power Company, San Francisco, Cal.; Leeds & Northrup Company, Philadelphia, Pa.; J. L. Mott Iron Works, New York, N. Y.; Precision Instrument Company, Detroit, Mich.; Prest-o-Lite Company, Indianapolis, Ind.; Roessler & Hasslacher Chemical Company, New York, N. Y.; Stone & Webster Engineering Corporation, Boston, Mass.; Taylor Instrument Companies, New York, N. Y.; Thwing Instrument Company, Philadelphia, Pa.; United States Bureau of Standards, Washington, D. C.; Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Property Owners Improve Lighting of Monroe Street, Chicago.

On September 27 the new lighting system installed by the Monroe Street Improvement Association along the seven blocks on Monroe Street from Michigan Avenue to Franklin Street, Chicago, was inaugurated with simple ceremonies. This is an interesting example of co-operation of property owners with the city to improve street lighting. This half mile of the street was formerly lighted by 20 of the city's standard 500-watt flame arcs, to which the association has now added 40 500-watt type C 115-volt multiple Mazda lamps in General Electric fixtures conforming closely to those for the city flame arcs. Along two of the blocks the lamps are mounted on top of each trolley post like those along Dearborn Street in Chicago. On the remaining five blocks, where there are no street-car tracks, the lamps are mounted on standard 25-foot ornamental posts used for city arc lighting from underground mains and described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN on September 6, 1913. A few of the city's posts had to be moved to conform to the new spacing, which averages about 80 feet apart along the curb; the lamps are placed directly opposite each other on both sides of the street. With the exception of the two types of lamps, the installation is uniform throughout this half mile of street. The city lamps are on standard 9.6-ampere, alternating-current series circuits fed by the Sanitary District of Chicago. The new lamps just added are fed individually or in groups from the Commonwealth Edison Company's 115-220-volt, three-wire, direct-current system.

The total cost of the 40 new lamps, fixtures and posts and their installation was close to $6,000. The actual wiring was done free by the Edison Company, which tapped its nearest mains or building services, running the cables under the sidewalks without tearing up the street pavement. The cost of the new installation, together with its operation and maintenance, was assumed entirely by the Monroe Street Improvement Association, which is composed of practically all the property owners along this portion of the street. Each owner pays $1 per front foot per year for this purpose. Each tenant of first-floor stores, banks or other premises also constributed 50 cents per front foot to help defray the first cost, but will make no further annual payments. For energy supply, patroling,

cleaning, painting, lamp-renewal and other operation and maintenance service a rate of $1.65 per 500-watt lamp per week has been made and a new general schedule for such all-night street lighting has been filed with the State Public Utilities Commission. The Monroe Street contract is for ten years, which entitles the association to certain discounts.

The illumination of the street is now of a high order. It is probable that the city will replace its flame arcs on Monroe Street with type C Mazda units, thus making still greater uniformity. On completion of the new bridge over the river the new lighting system will probably be extended two blocks to the bridge. Efforts are being made to extend such co-operative improved lighting to other downtown Chicago streets. A similar arrangement, differing in details, however, has been in very successful use about three and one-half years on nearly a mile of the busiest part of Dearborn Street (see ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, April 12, 1913). Herbert A. Seward, of Chicago, was consulting engineer on both these improvements.

MOST ELABORATE STREET LIGHTING INAUGURATED IN SAN FRANCISCO.

Resplendent Lighting of Market Street Opened with Grand Illumination Festival.

The first section of the elaborate scheme of street lighting which has been planned for the principal streets of San Francisco was completed and inaugurated on October 4 with a grand electrical pageant and illumination festival continuing for two days. The section involved is on Market Street from the Ferry to Seventh Street, a distance of about one and one-half miles. A total of 137 three-light standards, such as the one shown herewith, have been installed. These standards consist of ornamental cap, brackets and base mounted over the tubular steel trolley poles formerly in place. They are about 32 feet high and are spaced 110 feet apart. The lamps are General Electric ornamental luminous or magnetite arcs that were used at the Panama-Pacific International Exposition last year. A special type of sectional inclosing globe, made of San Francisco Gold Carrara Glassware, has been developed for this purpose. This is said to have an exceptionally pleasing appearance by day and night.

New Ornamental Post for Market Street, San Francisco.

The top lamp is lighted all night, while the two side lamps are operated till midnight only. The city pays for the operation and maintenance of the all-night lamps and the Downtown Association and the United Railroads (street-railway company) pay for the midnight lamps. The standards were installed by the Pacific Gas & Electric Company at a cost of nearly $100,000. The standards have an imitation bronze finish. They replace the former installation of five-light cluster posts.

The general scheme of improved illumination of Market Street and other important squares and thoroughfares of San Francisco, such as the Civic Center, was designed by W. D'Arcy Ryan, who also designed the principal floats used in the gorgeous parades of the illumination festival. The general plan of these floats was to give an allegorical representation of the history of lighting from the prehistoric cave man to modern times. This festival and pageant attracted thousands of visitors to the city.

WESTERN ELECTRIC MAKES ENORMOUS SALES RECORD FOR 1916.

Actual Gross Sales for Year Will Reach One Hundred Million Dollars. Incoming Orders Booked Will Make Total Much Greater. Extensive Plant Additions Costing One Million Dollars Authorized by Company.

The gross sales of the Western Electric Company for the year to close December 31, 1916, will reach $100,000,000. The company's previous biggest year's gross was $77,000,000. The sales for the present year of approximately $100,000,000 will be made up of actual shipment of goods to customers. The incoming orders booked will be very much greater than this enormous total. While the Western Electric Company has no war orders, it has felt the effect of the war by limitation of raw material supplies on the one hand, and an abnormal demand for its products on the other. The directors recognize the fact that present conditions are abnormal. At the same time the pressure is here and cannot be entirely ignored, and as a result the directors have authorized plant additions which will call for the expenditure of over $1,000,000. The Western Electric Company is now employing 23,000 people, the largest number in its entire career.

A Trouble Man's Duties Defined.—The Minneapolis (Minn.) General Electric Company has started a system of bimonthly examinations for trouble men. Among the questions asked is: "What are your duties?" One of the first answers secured in reply to this question is so comprehensive and expressed in so few words that it is considered almost ideal. The answer was: "My duties are to advance the present high standing of the company in the minds of the people, to render cheerfully any service that may be required of me, to treat everybody with the highest courtesy, to protect life and property, to maintain service, to repair customers' wiring and appliances where possible, to practice economy and efficiency and to report to the office frequently.

Miscellaneous NEWS NOTES

Association of Engineers to Meet.—The American Association of Engineers gave a membership booster dinner October 6 at the City Club, Chicago, Ill. C. Francis Harding, professor of electrical engineering, Purdue University, gave the principal address, on "Marketing Engineering Ability." Other speakers were John Ericson, city engineer of Chicago, W. H. Finley, chief engineer of the Chicago & North Western Railway, and Isham Randolph, consulting hydraulic engineer.

Civil Service Examination for Laboratory Assistant.—The United States Civil Service Commission will hold an examination October 11 and 12 for laboratory assistant in the Bureau of Standards, Washington, D. C. Some 15 or more appointments will be made in the near future as the result of this examination. Entrance salaries for these positions range from $900 to $1,200 a year. Applicants will be examined in general physics, French and German, and practical questions on several optional subjects; rating will also be given on education, training and experience. The optional subjects are advanced general physics, civil and mechanical engineering, electrical engineering, paper technology and textile technology.

Evening Electrical Classes at Lewis Institute, Chicago.—The evening school at Lewis Institute, Chicago, opens October 9. A special booklet giving an outline of the numerous evening classes given at this institution is now available to those interested. Among the large number of classes given are some 10 courses in electricity and electrical engineering. These cover both classroom and laboratory work and are arranged so they may be carried through a period of four years, each consisting of three 10-week terms of evening instruction. Numerous other courses are also given in mechanical drawing, steam and gas engineering, civil engineering, chemistry, etc. Prof. P. B. Woodworth is dean of the Lewis Institute evening classes and will be glad to furnish additional information.

Fire and Accident Prevention Day.—On October 9 the various interests that are aiming to reduce fire hazards and fire losses throughout the country have decided to hold various meetings in different cities with the object of stimulating interest in the movement through a national observance of Fire and Accident Prevention Day. In Chicago a special meeting will be held at the City Club at which appropriate addresses will be made by J. B. Finnegan, John C. Howatt and C. B. Scott. The meeting will be held under the joint auspices of the City Club, the Illinois State Fire Prevention Association, the National Safety Council and the National Fire Protection Association. October 9 is an appropriate date for this purpose, being the 45th anniversary of the great Chicago fire.

Opposition to Separate Lighting Rates in New Jersey.—In connection with the investigations of the Board of Public Utility Commissioners for reduction in present lighting rates of the Public Service Electric Company in certain sections of New Jersey, including Jersey City, Newark and neighboring municipalities, a protest has been filed with the Board by Northampton Township. In its petition, the township asks for a state-wide charge system, holding that a reduction in charges in the larger cities based upon their greater population will lead logically to increased charges or impaired service in the smaller districts. It is set forth that, while the cost of producing electrical energy may be less in the larger districts, the proportionate cost to the company due to higher assessed valuation, greater taxation and cost of maintenance offsets in a large measure the smaller amount of consumption in the sections where assessments are lower and maintenance cost less.

Lineman Climbs 800 Miles.—William Lane, an employee of the Rockford (Ill.) Electric Company, is a statistician as well as an electrician and declares that in the capacity of lineman he has climbed over 800 miles in the last 12 years. This is an average of 25 poles per day, or something like 110,000 times 40 feet. He has had few falls and no bad ones, and while he has come in contact with live wires a number of times, he has never been seriously hurt. Mr. Lane declares that a good majority of accidents to linemen are due to carelessness, poorly fastened spurs and harness, or to thoughtlessness.

Electric Railway Operates Car Ferry Across Bay.—The Oakland, Antioch & Eastern Railway is the only electric railway in this country that ferries its trains with passengers aboard to avoid change of cars en route. It has built a new car ferry capable of transporting six loaded passenger cars or eight freight cars. It carries the electric trains across Suisum Bay, Cal., pending the construction of a bridge about 10,000 feet long. The ferry is driven by a 600-horsepower gasoline engine. This electric line operates single electric cars, multiple-unit trains and trains drawn by high-speed electric locomotives. Included in its equipment are several parlor and buffet cars of the finest type. In every respect this line is a thoroughly modern and efficiently equipped electric railway.

Los Angeles Power Controversy to Be Settled.—Settlement of the power question of the City of Los Angeles may be accomplished by direct negotiations between the companies and the city, along lines suggested by Public Service Commissioner Boyle Workman and approved by the Municipal League. The plan, according to Martin Betkouski, president of the City Council, contemplates the filing of an application with the Railroad Commission for the rehearing of the Southern California Edison case. Pending the rehearing, it has been arranged at numerous conferences of the water board that Mr. Workman's plan for the amicable settlement of the power controversy through the purchase of the distributing systems of the three companies by agreement shall be worked out and a new offer made on behalf of the city. Meanwhile the Edison company's system will not be paralleled. The city has available for power approximately $4,800,000 in cash and unsold bonds, with about $700,000 against this for supplies and contracts already entered into.

Proposed Sale of Chicago Automatic Telephone System Falls Through.—Mention was made in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, March 18, 1916, of the sale of the automatic telephone system of the Illinois Telephone & Telegraph Company, which includes a number of exchanges and some 20,000 lines in Chicago, to the Chicago Telephone Company and the American Telephone & Telegraph Company for a consideration of $6,300,000. This sale was approved by the City Council of Chicago and also by the Illinois Public Utilities Commission. It was stipulated, however, that there should also be secured the approval of the Federal Government. The Federal authorities have refused to either sanction or disapprove of the sale, contending that they had no authority to act before the sale was effected. Therefore the sale has fallen through, since the six months during which the various consents were to be obtained have expired. Following this failure, the Chicago Tunnel Company, of which the Illinois Telephone & Telegraph Company is a subsidiary, has just begun suit against the American Telephone & Telegraph Company for $8,000,000, which is supposed to cover the agreed amount of the proposed sale and interest and incidental expenses; suit has been instituted on the charge of breach of contract.

Salt Lake City's Splendid New Street Lighting

Five Blocks on the Main Street of Utah's Metropolis Are Provided with Ornamental and Efficient Street Lighting Through Formation of a Special Lighting Improvement District with Uniform Special Assessments

SALT LAKE CITY celebrated the inauguration of its new White Way lighting district on the evening of September 29 with ceremonies, the like of which have not been seen for many days. Those in charge of the exercises were completely surprised at the interest displayed by the populace in the event. Main Street, which is generally known as one of the widest business thoroughfares in the country, was completely jammed for a distance of nearly two blocks. The Utah Power & Light Company had erected a large platform in front of its general offices on Main Street on which had congregated the president and board of governors of the Commercial Club, representatives of the Upper Main Street Improvement Association, prominent property owners, and citizens and representatives of the Utah Power & Light Company.

This new lighting system, which is generally referred to as the Salt Lake system, extends from South Temple Street to Fifth South Street on Main Street, a distance of five blocks or approximately three-quarters of a mile. It covers the entire retail business district on this principal thoroughfare. There has previously been more or less rivalry between the upper and lower main Street merchants and property owners, and since this system has been inaugurated it is believed sectionalism will vanish on the street.

President F. C. Richmond of the Salt Lake City Commercial Club, which has co-operated with the various interests in making this splendid system possible, acted as master of ceremonies and introduced the speakers. The Hon. John C. Cutler, president of the Upper Main Street Improvement Association, which took the lead in the movement that resulted in the installation of this system, was the first speaker and briefly outlined its history. The movement began in January, 1915, when a group of property owners were called together and plans for the improvement of their business district were discussed. One of the first things proposed was to install a lighting system second to none in the country. At the suggestion of representatives of the power company it was decided to notify W. D'Arcy Ryan, illuminating engineer of the General Electric Company, to come to Salt Lake City, study the situation and submit recommendations. This was done and at a meeting on February 3, 1915, Mr. Ryan appeared before the committee and presented his recommendations in the form of realistic paintings showing actual night views of Main Street as it would appear after the system was in operation. Those who witnessed the lighting effect after the turning on of the system could not but comment on the strikingly close comparison between the actual results and the predictions as illustrated by Mr. Ryan's artist.

In order to make the system permanently successful it was decided to appoint a committee to take up with the Legislature, then in session, the proposition of amending

Night View of Main Street, Salt Lake City, Utah, Showing Effect of New Street-Lighting System—A Civic Celebration Marked the Inauguration of the System.

the law already on the statute books creating special lighting improvement districts, this law having been found not to be in conformity with other laws pertaining to special assessments. The Commercial Club and others interested in the proposition co-operated with the committee and succeeded in having the law properly amended and signed by the governor. Petitions were then circulated among property owners. As originally contemplated, only one block on upper Main Street was to be installed, but as the movement progressed, first one block and then another was added until finally petitions were presented to the City Council asking it to create a lighting improvement district covering five blocks on Main Street. On March 20, 1916, the City Commission passed a resolution declaring its intention to make this improvement in accordance with the provisions of the law. Subsequently bids were secured, the contract was awarded to the Utah Power & Light Company and work started. It was originally intended to have the system in operation by midsummer, but this was found impossible owing to the delay in securing the material from the manufacturers.

Close-up View of One of the Ornamental Standards Installed on Main Street, Salt Lake City.

Mr. Ryan, the designer of the system, whose zeal and enthusiasm had been so potent in securing the confidence of the property owners and in convincing them that the system would be all that he promised for it, had made a special trip from San Francisco to attend the ceremonies and was greeted by rounds of applause when President Richmond introduced him as the man who had made the Panama-Pacific International Exposition famous by the lighting system he had designed for it. Mr. Ryan stated that on account of its broad streets, Salt Lake presented an unusually interesting problem in special street-lighting design. He called attention to the fact that he had promised the property owners that they should have a substantial and dignified standard with an evenly distributed illumination well out of the eyes of the pedestrians, which would give a practically uniform distribution of light on the street, sidewalks and facades of the buildings. He called upon the throng present, when the system was turned on, to witness how nearly his promise had been fulfilled. He closed by declaring "The West has always done the pioneering. Tonight we are making history. I am proud to have been associated with this magnificent piece of western enterprise."

The Hon. W. Mont Ferry, mayor of the city, was the last speaker. He praised the progressive citizens of Salt Lake City who made this enterprise possible, thanked those responsible for its being, and declared that this type of lighting hereafter would be known as the Salt Lake system and that Salt Lake City would derive much desirable publicity therefrom.

The old street-lighting system was then extinguished and the new one turned on. The band played, the crowds cheered and gazed about them in wonder. The illumination is over five times what it formerly was.

There are seven standards to the block on each side of the street, approximately one hundred feet apart. Each standard carries three 6.6-ampere, inverted-type General Electric luminous arc lamps. The standard fits over the regular trolley pole and completely conceals it. It has an ornamental cast-iron base and a pressed-steel column in two sections with the three-armed cast-iron fixture carrying the lamp mounted on top, the lamps being 29 feet above the sidewalk level. The lamps are equipped with special diffusing glassware. Each lamp is rated at 1,500 candlepower and the absorption in the glassware is approximately 30 per cent. The lamps are connected on two circuits, one circuit supplying 190 lamps, which operates until midnight, the remaining 20 lamps burning all night.

The total cost of installation of the system was $28,220. The cost to the property owners was $25,535, and the city bore the balance of the expense. The installation charge against the property owners amounted to $4.12 per front foot. The total cost of operation for the three-year period of the contract is $28,138, of which amount the city pays approximately $4,000. The cost of operation to the property owners is approximately $1.30 per front foot per year. The Utah Power & Light Company spent approximately $12,000 for rectifiers and other station equipment necessary to supply the installation. About 36,000 feet of steel-armored cable was used for the complete equipment of the new system.

The city issued to the Utah Power & Light Company in payment for the cost of installation and for the cost of operation for the period of three years, over which the contract runs, lighting improvement district bonds, which bonds are secured by a mortgage that is a first lien on the property included within the lighting improvement district. The company had no difficulty in disposing of these bonds at par. The property owners have the option to pay the cost of installation and operation in full or to pay it in three annual installments.

Ohio Engineers to Meet at Columbus in November.

The Ohio Society of Mechanical, Electrical and Steam Engineers will hold its annual meeting at Columbus on Thursday, November 16. A one-day intensive meeting will be held, for which several good papers are in preparation. The Society will receive a committee report on the advisability of combining with the Ohio Engineering Society at this meeting. F. E. Sanborn, Columbus, O., is secretary of the Society.

Electrification of Portland Cement Plants

An Analysis of the Processes of Manufacture in a Typical Mill with a Discussion of the Machines Employed and the Advantages of Electric Motor Drive—Based on Actual Operating Results

Industrial Power Series—Article No. 178

THE cement business is an industry that suffered greatly during the business depression early in 1915, but has come back to its own in the past eight months much stronger than ever.

South America before the war drew most of its supply of cement from Europe, principally from Germany and England. Due to the war, this source has been closed and we are supplying this product with the good chances of holding the market when Europe decides to stop fighting and go back to business.

While the subject of this article is to treat on Portland cement manufacture, it might be well to call attention to the fact that there are two kinds of cement manufactured in the United States, namely, "Natural" and "Portland."

In the first place, the manufacture of Natural cement is reducing until it is at the present time about 1,000,000 barrels per annum.

The manufacture of Portland cement requires considerable more power and hence more interesting to the electrical industry. The Lehigh Valley district, perhaps, is the largest cement field in this country. According to the United States government report of 1910, there was produced during the year 76,549,951 barrels from 111 plants, manufacturing Portland cement.

The plants located in the Lehigh Valley district use cement rock to which is added pure limestone, when the proportion of calcium is low, or clay, if there is not a sufficient amount of silicia and alumina. The first condition is usually found in this district.

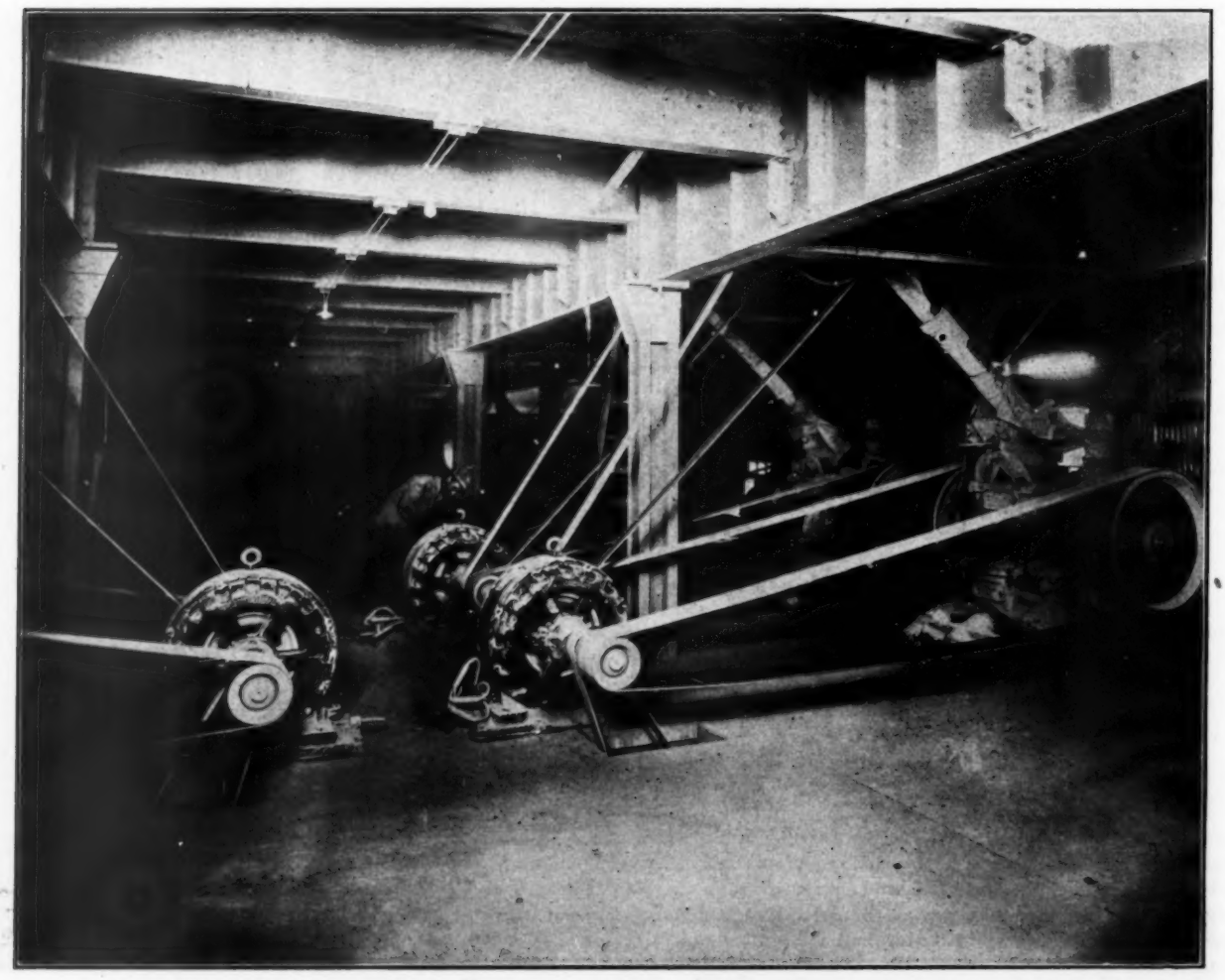
Quarry.

The quarry from which the stone is taken for cement manufacture, as a rule, is located very close to the mill, otherwise, the cost of transportation is so great as to seriously effect the cost of manufacture, and items of such cost is such an important consideration in the manufacture of the finished product.

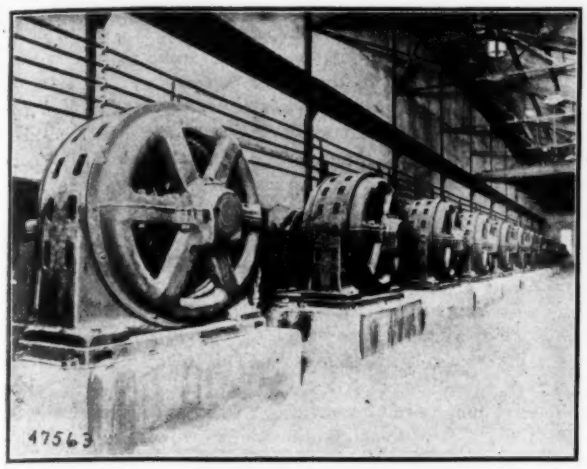
In the ordinary quarry, small drills are used and small charges of blasting powder used, but the usual cement quarry is drilled with large well drills placing heavy charges of blasting powder, taking down the entire breast of the quarry, amounting to thousands of tons of material.

This stone is loaded on cars of the usual automatic dumping type and drawn from the quarry with a steel cable up an incline to the bins above the crushers and passed to the next process.

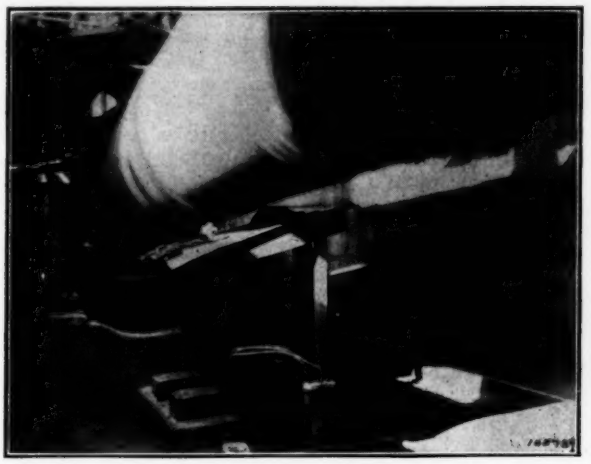
In a great many quarries a large amount of pumping is re-



View in Plant of Chicago Portland Cement Company Showing 40-Horsepower Motors Driving Kent Mills.



Tube Mills Driven by 200-Horsepower 25-Cycle Motors Running at 160 Revolutions Per Minute.



A 5-Foot by 40-Foot Clinker Cooler Driven by a 20-Horsepower Motor.

quired to keep it dry. These pumping equipments vary to meet the conditions encountered. Some of the quarry holes are quite deep and large quantities of water must be handled, while others are comparatively dry.

Process of Manufacture.

The process of manufacture in cement mills is about as follows. (1) Crushing; (2) grinding and mixing the raw materials; (3) burning; (4) grinding the clinker to finished cement.

The crushing in most plants is done almost entirely by gyratory crushers, reducing the rock from the quarry to sizes of about two to four inches then passing it through two or three smaller gyratory crushers to further reduce the size to one inch or less. Some plants use roll crushers after passing the gyratory, but the former method is used by the majority of the large plants.

After crushing, the rock is passed through a rotary dryer to remove all moisture and is then sent to the raw-grinding department.

The raw-grinding department receives this material together with the proper proportion of clay and reduces the mixture to a powder fine enough so that 90 to 95 per cent will pass through a screen having 100 holes to the lineal inch or 70 to 80 per cent will pass a 200-mesh screen. The practice is to reduce the material in a ball mill to pass a 20-mesh screen, and to further reduce to the 100 and 200-mesh size in a tube mill.

The material now in powdered form is fed from the bins to the rotary kilns for burning, coming from the kilns in the form of red-hot clinkers. The burning is done by crushing soft coal to a powder and forcing the powdered fuel into the kiln with blowers, the cement clinker coming out of the kiln about 0.25 to 1 inch in size. It is then cooled in cooling towers or rotary coolers, then ground in a manner similar to the raw-grinding department, to which about three per cent of gypsum or plaster of paris is added to control the length of time required for the cement to set. These materials are added to the clinker while grinding or after being ground. The cement is then stored and allowed to age before packing and shipping.

It might be well to describe some of the machines used, of which mention is above made.

Machines Used.

The tube mill is used more extensively than any other type of mill, when a very fine product is required. It consists of a horizontal steel cylinder lined with a hard cast-iron plate which is half filled with flint pebble. At each end is a cast-iron head with a journal projecting, which sets in a bearing to carry the weights. One of these journals is hollow, through which the material to be powdered is fed with a screw. The mill operates at about 25 revolutions per minute and the material is ground by the pebbles passing to the opposite end, passing through a coarse screen in the end of the cylinder. If the material is dry it is delivered to the bins; if not, it is passed through the rotary dryer.

The motors driving these mills must have a high starting torque, due to the load of pebbles being at the bottom of the cylinder, and the starting tops should be set at 85 per cent full line voltage, it being difficult to operate slip-ring motors in a cement plant on account of the dust. It is more practical to belt the motors than gear drive, on account of the severe vibration.

POWER REQUIRED FOR TUBE MILLS.

Size of Tube Mill in Feet	Horsepower
4.5 x 16	40
5 x 20	45
5 x 22	80
5.5 x 22	90
6 x 20	100
6 x 22	150
6.5 x 20	200

GYRATORY CRUSHERS.

Size of Stone to Be Crushed Inches	Horsepower
7	10 to 20
8	10 to 25
10	20 to 35
12	25 to 40
15	50 to 70
18	65 to 100
21	100 to 150
24	125 to 175
36	150 to 200
42	150 to 225

It will depend on the class of material to be crushed as to horsepower of motor to be applied, as with medium shale the lower horsepower in the table can be selected, while for very hard rock the highest figure should be used.

Belt drive seems to be the best drive for crushers to prevent injury, in case other materials such as iron finds its way into the mixture, or in case the crusher feeds too fast and chokes.

Rotary kilns vary in size, but the most common size seems to be 7 feet or 8 feet in diameter and 125 feet long. They are lined with fire brick. The kiln is supported on rollers at three points free to revolve and slightly inclined at one end, into which the raw material is fed. The kiln is fired at the lower end with a blast blowing pulverized soft coal, filling the entire tube with flame. As the kiln rotates, the materials work toward the lower end, during which process, all moisture and carbon dioxide is driven off and the cement raises to the fusing point, forming the cement clinker about 0.75 inch in size.

It is desirable to vary the speed of the kilns at times and a great many manufacturers prefer cone pulleys. Slip-ring motors are sometimes used, and if possible, it is most desirable to place the motors in a nearby room and belt to the kiln-driving mechanism, on account of the high temperatures encountered here.

The speeds shown in the accompanying table should be obtained when the motor rings are short-circuited. The starting torque on kilns is very high, especially when filled with ma-

terial, it being required to raise this entire weight until the material in the kiln starts to fall.

There is a large amount of the heat from kilns wasted, passing off through the stack, and there have been attempts made to raise this heat in waste-heat boilers, but due to the large quantity of dust driven off the boiler tubes become clogged, preventing satisfactory results from the boilers. Also, the expense for waste-heat boiler equipment is very high. The use of waste-heat boilers interferes with the results of the kiln process.

MOTORS FOR DRIVING KILNS.

	Speed R.P.M.	Horsepower at Given Speed	Motor Size, Slip Ring
6 by 60 feet	2	6 to 9	10
7 by 80 feet	2	8 to 10	10
7 by 110 feet	1	9 to 11	15
7 by 120 feet	1	11 to 13	15
8 by 125 feet	1	15 to 20	25
10 by 140 feet	1	24 to 30	35
10 by 175 feet	1	27 to 30	35
12 by 240 feet	1	60 to 70	75

Rotary dryers are used for drying the rock, clay and shale, also for drying the moisture from the coil before it is used in the kilns, it being very important to supply the kilns with dry fuel.

In most cases, the rotary dryer is belt driven and operates at 60 to 80 revolutions per minute, depending on its capacity. A countershaft is used to permit the use of a high-speed motor, while the starting torque required is high, if the machine is started when the dryer is loaded with material. A squirrel-cage motor in most cases will operate successfully. The power required ranges according to size of dryer, a 21-foot by 4-foot dryer requiring 5 horsepower, while a 46-foot by 7-foot dryer requires 25 horsepower.

Most plants allow the clinker to cool after leaving the kilns, while others use rotary coolers. These rotary coolers are very much like rotary dryers, both in construction and operation, passing the material into the upper end of the long revolving tube, set at a slight incline, and passing through to the lower end. There is a wide range of speeds at which rotary kilns are operated in various cement plants.

It would not seem that elevators and conveyors in a cement plant would be of much importance, but the contrary is true for the reason that to have a conveyor or elevator stop will in most cases shut down an entire unit of the mill with the resultant loss in production, and, as it shall be seen later in the matter of distribution of charges in the cost of manufacture, the overhead is a very considerable item.

The three methods of driving elevators and conveyors are individual, group and common shaft drive, and this is one case of supplying motors where the recommendations are reversed, namely, common shaft, group drive, and individual drive.

Elevators and conveyors, are, as a rule, crude machines. The chains on elevators frequently climb the gears and screw conveyors will often wear the bearings down to such an extent that the screw will drag or rub the bottom of the trough, and, if driven with individual motors, the trouble will often be discovered when the motor burns out. On group drive this is not likely to happen, due to the larger capacity of the motor and the diversity of the load. Squirrel-cage motors are recommended for elevators and conveyors and they should be liberal in size. It is difficult, however, to give a guide as to horsepower required, the sizes and capacity varying over such a wide range.

The selection of voltage for the distribution system in cement mills very largely depends, as in all other cases, on the center of distribution and the load to be carried, but with the difference that too high voltage about a cement mill will cause trouble due to the cement dust. Most of the modern plants are using 550 volts, three-phase. This seems to be the most practical secondary distribution voltage, while the primary voltage should never exceed 2,000 volts unless especially laid out to meet the severe conditions encountered, which subject shall be covered later.

Motor bearings should always be made dust proof, and great care should be taken to see that the dust cap and felt washers fit tight. The oil should be drawn off frequently and bearings well flushed with clean filtered oil. Gears when used must be well protected from the dust.

The foregoing treats of the various machines used in the manufacture of cement. There is other auxiliary apparatus to be considered in the electrification of cement mills, such as weighing machines, coal pulverizers, coal blowers, bag cleaners and cooperage-shop machinery, etc.

To manufacture cement on a profitable basis, it must be manufactured in large quantities, which is the reason for erecting the large present-day mills. A 2,000-barrel mill is now considered a small one.

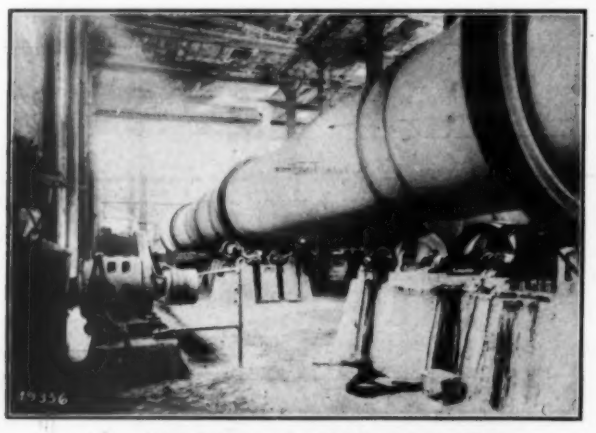
To give some idea as to the relation the various items bear to the total cost in the manufacture of cement, the following is quoted from Ekel's work on the manufacture of cement, and based on a 2,000-barrel plant.

Labor	$0.15
Supplies	0.09
Gypsum	0.0175
Fuel for burning Cement	0.1125
Fuel for Power	0.1125
Office Force, Packing and Shipping	0.06
Fixed charges on Plant	0.235
Total	$0.7775

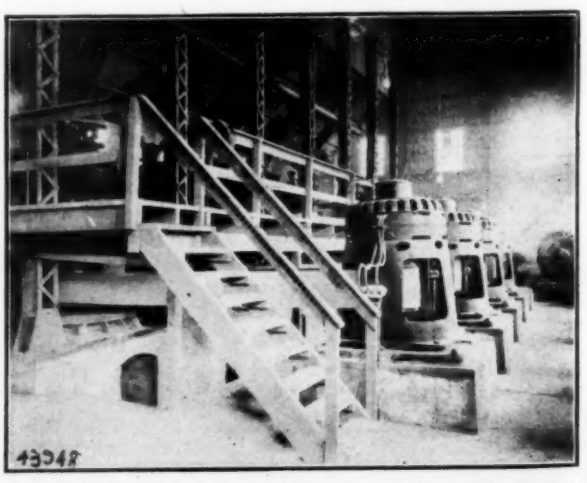
From the above, it can be readily seen why cement mills operate 24 hours per day and seven days per week; also that the fixed charges would be high in a small plant as against a large one.

Advantages of Central-Station Service.

It is at this point where the greatest advantage of electric drive can be shown, and also, that it is economy to purchase power from the central station despite the fact that so many



Rotary Kiln Driven by a 50-Horsepower Motor.



Four 42-Inch Fuller Mills Driven by 75-Horsepower Vertical Motors.

so-called experts will say that the power load in a cement plant so closely approximates the ideal characteristics that it is possible for them to produce power cheaper than the central station.

In the first place, a superintendent of a cement mill is a cement manufacturer, and is first interested in the quality of the finished product, which requires his close supervision and attention, and he cannot give time and study to power-plant economies. If he had a high-priced organization in his power plant it increases his production costs beyond that of his competition. This holds good because the demand for the product varies over a wide range and when production is low costs are high.

By referring to the above costs, it will be noticed that fuel alone for power is $0.1125 per barrel without considering labor, oil, waste, packing, repairs, superintendence and miscellaneous items which go to make up power costs.

It requires approximately 15 kilowatt-hours per barrel of finished product in an electrically driven mill, where the advantages of electric drive are taken into consideration. There has been a record to the writer's knowledge of considerably less than 15 kilowatt-hours per barrel, but that figure is fairly close for a 4,000-barrel mill. If central-station energy is used, the cost of power increases or decreases with the mill output, while with an isolated plant this advantage is not to be enjoyed. The cement manufacturer also finds that when the market demand is low his price must go down and his costs are going up, so that he finds himself in a difficult position to meet the competitor who is purchasing his power. There are many cement-mill superintendents at present who can look and will look back in the business depression of early 1915 and acknowledge that condition of affairs.

It should be borne in mind that a mechanically driven cement plant is subject to a very high friction load so that the amount of power delivered to the machines in many cases is double that of an electrically driven plant, so that it is a question of total cost of power per year and not the cost per kilowatt-hour.

Motor capacity will range between 1 to 1.25 horsepower rated per barrel mill capacity. There seems to be the usual tendency to install motors slightly larger than actual requirements, but due to the hard service the fault is on the right side.

Operating Data.

The accompanying data will give a clear conception of the operating characteristics of cement mills in the first tabulation. The mill is partly electrified, while the second mill is electrified except the outlying parts of the mill.

Month	Actual Demand	Kilowatt-Hours	Load-Factor Per Cent
July, 1915	488.75	301,950	84.7
August, 1915	481.25	286,050	81.5
September, 1915	516	254,950	67.5
October, 1915	513	293,000	78.4
November, 1915	524	297,600	77.9
December, 1915	504	259,400	70.6
January, 1916*	492.5	208,800	58.0

*(Mill down for repairs.)

Month	Actual Demand	Kilowatt-Hours	Load-Factor Per Cent
July, 1915	1028.75	634,000	84.5
August, 1915	1035	629,000	83.4
September, 1915	1052	627,200	81.8
October, 1915	1119.5	625,000	76.5
November, 1915	1054	607,300	79.0
December, 1915	1066.9	466,200	60.0
January, 1916	1054	560,600	72.9

In computing the results of operation in a mill now in process of electrification, which will have a demand of 3,000 kilowatts, it is estimated that the consumption will be 20,007,700 kilowatt-hours per year with a load-factor of 75 per cent.

This load when interposed on the ordinary central-station load has a material effect on its operating economy. This load will operate on a line which is serving two small towns and two large manufacturing plants with the following percentage relation of demands and consumption of energy.

	Per Cent of Investment	Per Cent of Demand	Per Cent of Consumption
Town A	1.2	1.2	0.57
Town B	5.9	5.9	2.98
Manuf'c'g Plant A	30.4	30.4	30.85
Manuf'c'g Plant B	62.5	62.5	65.6

From this the relation each of the factors bears to the total can be seen. The following will give the relative factors on the same situation, but with a load of 2,000 kilowatts added to the line. The addition of this load is considered in the proportions given.

	Per Cent of Investment	Per Cent of Demand	Per Cent of Consumption
Town A	0.56	0.55	0.2
Town B	2.75	2.75	1.45
Manuf'c'g Plant A	14.3	14.3	13.65
Manuf'c'g Plant B	82.4	82.4	84.7

With the above relations worked out on a given proportion and the central-station man knowing his plant investment, distribution and operating costs, it is an easy matter to work out in full detail what the result of such added business will bring to his station-operating economy and the revenue to the company. If the plan is followed we will not pass by business which is not only profitable in itself but productive of better results from an operating standpoint.

One of the important features is the transmission system adjacent to cement mills. The cement dust from these mills collect on the insulators and during damp weather forms a cement coating over them, setting so hard that it is impossible to remove. If allowed to collect it will gradually build up to considerable thickness, causing the line to ground.

To overcome this trouble an insulator, comprising a large inverted bowl placed on the top of a standard 33,000-volt insulator, is used and permits of a large surface easily cleaned about every two to three weeks. It seems to be the only way to overcome this trouble, which has been the principal cause of failure on these lines.

Valuable Papers Will Be Presented at New England Convention.

A program strong in both technical and commercial features will be that of the New England Section, N. E. L. A., convention, to be held at Pittsfield, Mass., from October 17 to 20.

An innovation for the opening evening will be an entertainment of readings and stories by LaRue Viedenburgh, of the Boston Edison Company, and Charles C. Pierce, of the General Electric Company. Dancing will follow. Papers will be as follows:

Wednesday.—Obtaining Large Power Business, W. C. Durant, New England Power Company, Worcester, and W. B. Lewis, Providence, R. I.; Determining Demand of Large Power Users, R. S. Hale, Boston; Industrial Heating, E. F. Collins, General Electric Company; Use of Central-Station Service by Large Power Users, David Elwell, Boston; Report of Heating Research Committee, G. F. Parsons, chairman, N. E. Section Committee, D. S. Boyden, National District Heating Association Committee.

Thursday.—Report of Accounting Section Committee, Bowen Tufts, chairman; Value of Accounting Records in Business Development, Franklin L. Hall, Providence, R. I.; Municipal Ownership Discussions, D. A. White, Cambridge, Mass.; Determining Fair Rates, G. L. Halstead, Dover, N. H.; Issuing Securities, H. A. Gidney, Boston; Handling Stock as Money, G. W. Huron, Haverhill, Mass.

Thursday.—Report of Public Policy Committee, R. W. Rollins, chairman, Worcester, Mass.; Public Service Session, remarks by members of State Commissions; Electric Vehicle Development, E. S. Mansfield, Boston.

Friday.—Report of Commercial Section, E. R. Davenport, chairman, Providence, R. I.; The Commercial Section's Big Work, E. A. Edkins, Chicago; Electric Ranges, A. L. Smith, Jr., Boston; Appliances and Merchandising, A. H. Allcott, Providence; Effect of C Lamp in Municipal Street Lighting, John West, Boston; Store Lighting, A. H. Heininger, Boston.

Central stations and manufacturers will make an extensive display of "sales helps" advertising.

Guarding Against Municipal-Plant Agitation

Real or Supposed High Rates, Politics, Poor Service and Indifference to Public Requirements, the Principal Causes of Municipal-Ownership Agitations, Are Discussed

By Glenn Marston

IT WAS Patrick Henry who is reputed to have first said: "We have no way of judging the future save by the past." Such being the case, the central-station industry can look forward to municipal-plant agitations galore, the installation of some plants, and the decline and fall of some of them. The decline, however, is likely to work contemporarily a serious decline in the revenue of the companies which happen to be in competition with the municipal plants.

All municipal ownership agitations do not blossom into plants. The trouble is that nobody can tell which agitations will be developed into full-fledged city-owned enterprises. There is nothing left for the central-station manager to do, then, if he does not want municipal ownership but so to conduct himself that the danger from municipal-plant agitation will be reduced to a minimum.

Municipal plants are seldom advocated because the people believe municipal ownership is a good thing. The people generally go only so far as to believe that a municipal plant will not be worse than the example of private ownership existing in their community. Out of nearly 50 cases of incipient municipal ownership with which I have been connected, only one was advocated by a real believer in municipal ownership, and when that went to a vote it was defeated by four to one.

The chief causes of municipal ownership agitations, as far as my experience goes, are real or supposed high rates, politics, poor service, and indifference to public requirements. While some of the time there are two or more of these chief causes involved, only one seems to be necessary in order to start a first-class agitation.

Of these causes, the most important is the question of rates. It makes no difference whether the rates are really high or not. If the people think they are high, the trouble begins. Sometimes the dissatisfaction is only with street-lighting rates.

Rate Question Serious.

The rate question is a serious one on account of the innumerable rate systems in vogue. There is hardly any class of customer who cannot find some other town where his particular rate is lower. It makes no difference to him whether other rates are higher or not. He knows that someone in another town has a more liberal and better managed company than the one which serves him.

Take street lamps, for example. I was called to a town once where the claim of the council was that street-lighting rates were too high. They were then paying $70 a year, while a neighboring town was getting its street lighting for about $18 per lamp per year. Investigation showed that one town gave all-night service, with 6.6-ampere arc lamps while the other was lighted with 40-watt Mazda lamps on a moonlight schedule. The 40-watt lamps were new then and the town was pretty proud of them. They had been using 32-candlepower carbon lamps before, and felt that the change was beneficial. It is the most common thing to find lamps of entirely different types and hours of burning submitted by an alderman as a reason for reducing local rates.

Along will come someone who knows of a municipal plant where street-lighting prices are away down to $29 or $30, and he has the best part of the newspaper in which to tell about them. The reporter goes around to the manager of the company, who has nothing to say, for fear he will say the wrong thing. In a great many cases, saying the wrong thing is not worse than saying nothing at all, proverbs to the contrary notwithstanding.

Tell Your Story Through the Newspapers.

Every manager knows that newspaper reporters should be cultivated. Many managers soften their refusal of a story by passing out a cigar to the reporter, but, after all, the reporter cannot hold his job by bringing back cigars to the office. He is hired to bring back stories, and cigars are not accepted as substitutes. They are all right as supplements, but that is all. Turned down by the manager, the reporter goes to a man who will talk, and the silent one gets the worst of it, naturally. I have seen cases where this has been allowed to go on for years, the company saying nothing for fear of saying something which will bob up in 20 years and embarrass the management, while the company's critics, having no boomerangs to fear, screeched merrily on their way.

The public is bound to believe what it hears often enough, and the thing it ought to hear is the truth about the public-service companies. It ought to be told something about the rate system in force, and the reasons for various rates. The manager has taken four years in college to learn the bare fundamentals of his business, yet he often expects to start a newspaper campaign three weeks before election and make the whole thing clear to a public made hostile by the reiterations of his critics. The reporter, like most of the rest of us, also loves a fight, and his natural tendency is to start something which will draw fire from a new source of news.

I had an instance in New England, where the rate question was uppermost, complicated by some local politics. The rates of the company were among the lowest in the state, yet the agitators were able to convince the people that they were being robbed by the company, and cited a few municipal-plant rates to show what the company was not doing. It may well be that these politicians had no real thought of establishing a municipal plant, but their propaganda got away from them. What chance had the company, after these low municipal rates had been quoted and bandied about town for weeks, to go into an analytical interview showing the items of expense which the municipal plant was not meeting? This should have been done long before. The people should have been taught that municipal plants often omit items of expense in their reports, and base their rates on faulty accounts. Then, when the rates of a municipal plant are quoted, the first thought of the reader will be to reserve judgment until he finds whether the quoted plant is one of the pretermittent variety. On the other hand, when this educational work is left until too late, the public deems the company to be trying to slip something over when it goes into details regarding municipal oversights. The public sees the rate, and that is the evidence. Details are beside the issue.

I have come across some cases where there were rate agitations which were totally unjustified, and where the company could have saved itself much worry and expense by doing at the proper time what it had eventually to do anyhow. In one case in particular the company's rates were very low, and, safe in the knowledge that its rates

were easily defended, it proceeded not to defend them at all. The rate agitation was allowed to develop into a municipal-ownership movement before the company awoke to the true situation.

In most rate cases the public at large is only interested in the maximum rate, and does not care what reductions are secured by various classes of business. This resulted in an amusing situation once. The mayor was strong for a reduction in rates to the little fellow. He wanted all users to pay the same rate, but, being convinced of the injustice of any such rate schedule he contented himself with insisting that all residence consumers should pay the same price per kilowatt-hour instead of the two-rate system which was in use. His original demands were impossible, and were simply made by him for trading purposes. Finally, at his own suggestion, a rate was adopted which was a little more than two cents less than the existing rate. On the residence business as it stood then, this "reduction" increased the gross revenue of the company. Yet the mayor was able to claim a triumph over the grasping corporation, which he immediately did.

Low Initial Rate Desirable.

It has been for years a serious question how far expediency should be permitted to modify theoretically sound rates. Reduced to its simplest form the rate question is one of getting at least a certain gross revenue out of a certain number of customers. What proportion each of these customers should pay constitutes the problem. It is possible to imagine a company with the need of earning $10,000 a year, with 100 customers, each paying $100 a year. It is not possible, however, to imagine the state of mind and voice of the smallest of these customers, who would pay $100 a year for two lights in his house, as compared with his neighbor who used 75 horsepower continuously in his factory. Expediency (and common sense) would make it advisable for this imaginary company to readjust its rates.

After countless curves and calculations, we are about as far from a truly fair rate system as we were in the early days. Each practicable rate system is subject to very proper criticism. Because of scientific calculations, which showed that residence business is costly, it has been difficult for many companies to see the expediency of giving anything but a high initial rate to residences, even though a low secondary rate is given in connection with it. The high initial rate, when compared with other low rates near by, is bound to create dissatisfaction, for it is the initial rate which is fixed in the public's mind.

The Jacksonville Case.

A good illustration of the reverse of the high initial rate theory is the municipal electric light plant at Jacksonville, Fla. This plant has been quoted from one end of the country to the other as an example of successful municipal ownership at low rates. It has for many years had a maximum rate of 7 cents per kilowatt-hour. But up to the middle of 1913 there was a minimum bill of $2.00 per month, so that the plant got at least $24 per year from every customer. There are many light users who have a consumption of 10 kilowatt-hours a month or less, and these users, in Jacksonville, with a published rate of 7 cents, were actually paying 20 cents a kilowatt-hour or more!

In 1913 the rate system was revised, and the $2.00 minimum was abolished. A so-called 50-cent minimum was established in its place. But the new minimum paid for no energy. It was a service charge, and the 50 cents must be paid in addition to all energy used at 7 cents a kilowatt-hour. Thus the user of 10 kilowatt-hours a month pays 70 cents for his electricity plus the 50-cent service charge—a total of $1.20 or at the rate of 12 cents a kilowatt-hour, though the published rate is 7 cents!

Private company practice is just the opposite of this. There are companies who get an average of about six cents a kilowatt-hour from their residence business, but who have a maximum rate of 10 cents, and it is on this 10-cent rate that they are judged. With an apparent 7-cent rate the Jacksonville plant certainly gets a greater average revenue per residence customer than many companies whose rates start at 10 cents per kilowatt-hour, and there is no question but that this apparent 7-cent rate has been the chief factor in making Jacksonville so popular as an example of successful municipal ownership.

Comparisons of rates in different communities should be discouraged as much as possible. There are different conditions in every city, and there are bound to be differences in the details of rates which make fair comparisons impossible. However, the advocates of municipal ownership are very much given to making comparisons, and companies frequently must do the same in order to protect themselves.

The Public Must Be Educated.

More important is the teaching of the public to understand why comparisons are valueless. This teaching should be done before the comparisons are made. If it is not done the comparisons certainly will be made, and the company will suffer. General Forrest said that victory consisted in "gettin' there fu'stest with the mostest men," and the utility manager can do no better than get there fu'stest with the mostest facts.

A company loses a great advantage if it waits to be attacked. Public education must go on all the time. The tendency is to wait for trouble, and then worry a lot about how to get out of it. Keeping out can usually be accomplished with half the worry, and half the work, if the manager will only look into the future. That he lives in and for the present is generally not his fault. Running a utility is a considerable job, and the employment of a specialist to keep a company out of trouble seems to be an unnecessary burden on operating expenses, especially when he does his work so well that the trouble does not come.

Many rate agitations could be avoided by familiarizing the public with the principles underlying the rates in force. The company might go even further and discuss other rate systems, showing the advantages of its own. This is hardly proper matter for the news columns of a paper, but it is money well spent to take space in the advertising section. Good-will advertising does not always show the direct returns that are shown by commercial announcements, yet they have their value. They prepare for the future, and they disarm criticism before it is spread broadcast. It is too well known to need proof that it is possible to do more business with a friendly public than with an unfriendly one. Securing public friendship is not done merely by giving good service and keeping still. The majority of people are happiest when they are talking or being talked to. They choose their friends among those who tell them things. The utility that tells of its good deeds is the one which has the widest circle of friends and sells its output most easily.

Controversy on Stringing Telephone and Power Wires Settled by Commission.—At a conference before the Nebraska Railway Commission a controversy between the Gibbon Telephone Company and the Kearney Power Company was settled by the agreement of the latter to pay several hundred dollars to assist in the canvass of telephone patrons to secure their consent to the change in service necessary. The Gibbon company had asked the Commission to force the Kearney company to pay all the expense of the changes in its wires made necessary by stringing transmission lines, but this was withdrawn. The settlement does not affect other cases of dispute between telephone and telegraph companies.

Abstracts of Illuminating Engineering Society Lectures

The Principles of Interior Illumination[1]

By J. R. CRAVATH

IN considering the output of light from different sources it is necessary to know the distribution, the total lumens and the brightness per unit area. Distributions are usually given by means of the polar photometric curve, upon which figures of the total flux of light for each zone are written, in preference to using the Rousseau diagram. Short-cut methods exist for getting the total lumens from such a diagram. Distribution can be modified by the use of reflectors and brightness can be modified by the use of diffusing glassware. The most concentrated control of light requires the use of reflectors giving specular reflection. Less concentrated distribution of light is obtained by changing the shape of such reflectors or by using such surfaces as mat aluminum. Such reflectors may be of the intensive type or of the extensive or distributing type. Deep bowls are used not only to get the desired distribution but to shade the source from the eye. Shallow bowls lose less light internally. The flat type of reflector has only a limited application. Diffusing bowls should be of a dense glass in order to keep the brightness to a low value.

For indirect and semi-direct lighting it is best to distribute the light evenly over the ceiling, but this is usually less efficient. The brightness of the sky varies under different conditions from about 70 to 2,000 millilamberts. The brightness of interiors lighted by daylight varies from 1 to 50 millilamberts. The brightness of surfaces used in artificial lighting varies from extremely high values down to about 70 millilamberts for the ceiling directly over an indirect unit. Semi-direct bowls range from 35 to 1,000 millilamberts.

In designing an installation allowance must be made for depreciation in use. The accumulation of dirt on glassware causes a loss of intensity which may vary from 4 to 35 per cent a month. In calculating the necessary light flux it is usual to consider the illumination intensity on a horizontal plane 30 inches above the floor. The utilization-factor is the ratio of the lumens received on this plane to the total lumens. By using a suitable factor the light flux which it is necessary to generate is obtained and suitable units may be chosen. A computation by the point-by-point method is too laborious and fails to consider the reflection of light from the walls. Empirical methods based on experience are the most important to the engineer and are subject to errors only from incorrect assumption of similarity to existing installations. Utilization-factors vary from 13 to 60 per cent according to the type of unit used, color of wall and other conditions.

The hygienic aspect of lighting requires not only that sufficient light be supplied but that it be distributed properly in the field. There must be an absence of violent contrasts and freedom from sharp shadows. Glare is an excess of light which leads to fatigue, discomfort or interference with vision. Tests of eye fatigue indicate that no object should be more than 200 times as bright as the background and it is preferable that it be only 100 times. Apparently there is no reduction in the ability to see if the bright object is more than 25 degrees away from the line of direct vision, but it may be annoying anywhere in the field.

The necessary quantity of illumination depends upon the character of the surface illuminated, since the brightness of that surface is the important thing. Dark surfaces require a higher intensity of incident light. The eye works best when the object illuminated is of about the same brightness as its surroundings. A table of desirable intensities was given. Shadows arise from the use of a single or too few light sources and may be avoided by using more or by recourse to indirect or semi-direct sources. Bare sources of light are both unhygienic and inartistic. Yellow tints are preferable in artificial lighting as green, blue and violet are ghastly and disagreeable.

The process of designing an installation consists in ascertaining the requirements, calculating the necessary flux and selecting the appropriate type and size of unit. The flame arc lamp is admissible for very large structures, foundries, etc. The mercury-vapor lamp is suitable for factories and offices, but is not artistic. The usual choice lies between the gas mantle and the incandescent electric lamp. In comparing efficiencies, depreciation and maladjustment of mantles, etc., must be considered. Gas units may give only 40 to 70 per cent of the light obtained under laboratory conditions and the electric lamp 50 to 80 per cent. Convenience of control and cost of operation must also be considered. Other items for consideration are the blackening of the ceiling from gas, the steadiness of the light, the cost of renewals and glassware for each. No illuminant should be chosen which does not permit the use of the proper accessories to avoid glare. This is especially important in rooms where people remain stationary.

After selecting the type of unit and knowing the total flux of light necessary, the choice of size of unit and location is determined by local illumination requirements. Usually the minimum as well as the average intensity is specified and it may usually be kept within 25 per cent of the average. Outlets are usually arranged symmetrically. The height of the source should be not less than half the distance apart and spacing at shorter intervals is desirable. Examples of typical installations were then worked out. In making cost comparisons it is necessary to consider the following items of cost: (1) energy or fuel; (2) renewals; (3) cleaning; (4) decorating of walls, etc., due to use of lighting units; (5) interest and depreciation on the investment.

1. Two Lectures.

Abstracts of Illuminating Engineering Society Lectures

Modern Lighting Accessories

By W. F. LITTLE

THE object of accessories is to re-direct, diffuse or interrupt the light and to protect the source of light. The principal development since 1910 has been to reduce the brightness of the source by using diffusing glassware as a secondary source. Accessories give control also over the direction of light. The older predominating forms of prismatic and mirrored glasses have been supplemented with newer forms. They enable us to apply illuminants most efficiently and the cheapening of energy has promoted this development.

The shapes of accessories depend upon whether used for reflection, transmission or diffusion. The principal materials are metals, glass, marble, ceramics and fabrics. Uses may be classified as (1) utilitarian, (2) utilitarian and semi-decorative, (3) semi-utilitarian and decorative, (4) decorative. In the first class color or efficiency is the main point, regardless of appearance. The reflector is the usual form and the most practical is white enamel, although aluminum, aluminum-bronze and glass are also used. In the second class reasonable efficiency and appearance must be considered. Reflectors and bowls of clear, white or mirrored glass are most frequently used. In the third class appearance comes first with reasonable efficiency and control. This includes reflectors, globes, shades and bowls of the transmitting, translucent and opaque types. Fabrics may also be used. The fourth class includes iridescent and enameled glasses, art glass, fabrics, pottery, etc.

Glass accessories may be divided into four classes, according to method of manufacturing; clear, opal, cased glass, suspension or alabaster type. Opal glass is typical of diffusing glasses; cased glass consists of a casing either inside, outside (or both) of crystal glass. The alabaster type consists of crystal glass with particles in suspension. It varies from almost opaque to almost transparent. It may be pressed or blown. The finish of glassware may involve annealing, fire polish, polishing, bending, etc. Metal accessories are made by spinning or pressing and finished by polishing, enameling, painting, lacquering, etc.

With respect to transmission, glassware may be classified as clear, prismatic and diffusing. Clear glass transmits light unchanged; prismatic glass gives redirection without diffusion; diffusing glass gives both redirection and diffusion. Tables of values of the reflecting, transmitting and absorbing qualities of different types of glassware were given. The most concentrated source gives the most accurate control by reflectors. Reflectors must be designed for the type of lamp with which they are to be used. Distribution curves were given for reflectors of various types. Glass units are often designed for looks without regard to efficiency. Ground or cut glass accessories have no value in redirecting the light. Mirror reflectors give high efficiency and perfect control, the loss being only 15 to 20 per cent. The corrugations must be finer for concentrated filaments and depreciation is a serious matter with gas-filled lamps.

Few fixture manufacturers are applying good principles to their output. Many types are put out with bare frosted lamps, with no effort to redirect or control the light. Crystal and bracket fixtures are still popular. There is a tendency to use a larger number of small units. The state of affairs is really alarming.

Color in Lighting

By M. LUCKIESH

THE eye is not analytic, but synthetic, and color sensation arises from a mixture of light of different wave-lengths. The psychology of color has not been completely worked out, but we know that surroundings and previous stimuli affect sensations. Color and brightness should be separated in lighting problems. Colored lights may differ in hue, saturation and luminosity. Hue depends upon the wave-length. Saturation or purity depends upon the presence or admixture of white light. Luminosity depends upon the intensity of the light, and may be varied through a large range of tints and shades. The value of a color may be measured in terms of three primary colors, such as red, green and blue. Color mixture may be additive or substractive. Red, green and blue are the additive primaries, while reddish purple, greenish blue and yellow are the subtractive primaries. The first are of importance in mixing colored light, while the latter apply to the mixture of pigments. The theories of color vision were explained. On account of the chromatic aberration of the eye, monochromatic light gives higher acuity. Valuable effects can often be obtained by the proper use of colors. Those near the red end of the spectrum give an effect of warmth, and are especially applicable to rooms with northern exposure. Colors near the violet end of the spectrum are cold, and suitable for rooms with southern exposure. Artificial daylight can be obtained and older illuminants can be stimulated by the use of a proper absorbing glass.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

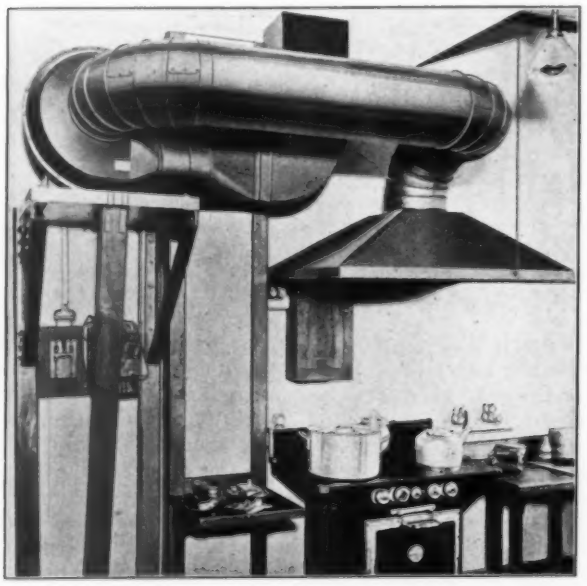
Return Postal Used in Range Campaign for Making Appointments.

In connection with its campaign for the introduction of low-priced electric ranges, which the company has been selling in large numbers for $15, the Boston Edison Company mailed out return mailing cards on which an electric range was pictured, and a request for a representative to call and describe the best way for the prospective customer to wire his house and take advantage of the low heating rate of two cents, after a small primary use per month, on a meter separate from the lighting circuits. Space is provided for the signature and address, with the date and time when most convenient to see the company's salesman.

Complete Electrical Equipment in Kitchen of Telephone Students.

In the kitchen maintained in connection with a restaurant for its employees who are learning the duties of central operators, the New England Telephone & Telegraph Company at Boston has installed a complete electric kitchen, with range, table stove, hot-steam table and exhaust blower.

About 75 persons take their meals in this restaurant, which is in the Telephone Company's Oliver Street building. The range is a General Electric, with oven, two hot tables and three cooking compartments. Over the range is a Sturtevant exhaust fan for removing the odors of cooking. On a table near at hand is an electric table stove for keeping dishes hot and for heating water, and



Electrically Equipped Kitchen.

at the serving counter is a four-compartment steam table, supplied by Duparquet, Huot & Moneuse Company, Boston. This apparatus is to enable the serving of dishes hot, direct to the patrons.

Large Power Contracts Signed by Commonwealth Edison Company.

Among the large contracts secured recently by the Commonwealth Edison Company, Chicago, Ill., for power and lighting service are included those with the Sherwin-Williams Paint Company, for its Kensington, Ind., factory, 1,000 kilowatts maximum demand, displacing an isolated steam-turbine plant; Mechanical Rubber Company, Chicago, 700 horsepower in motors; the Electric Building, in West Jackson Boulevard, displacing an isolated plant; Hotel Morrison, part of which is now being constructed; Chicago Grey Metal Company, Electric Steel Company and Trojan Steel Company, for the operation of electric furnaces, and contracts for supplying energy for two new ice plants where, in addition to manufacturing ice, indoor skating rinks will be operated in the winter months.

House-Wiring Record Claimed by Louisville.

That Louisville, Ky., with more than 50 per cent of all its houses wired for electric lights, has, since February 1, 1914, wired more than 10,000 houses, is a statement made by the commercial department of the Louisville Gas & Electric Company. So far as the officers of the Louisville company can find out, this is the best record, on a per-capita basis, that any city in the country can show. One of the reasons is that the Louisville Gas & Electric Company and the contractors of the city have been co-operating throughout the entire period. In a recent statement to local contractors, Donald McDonald, vice-president and general manager of the company, pledged continued co-operation of the company with the contractors.

Telephone Courtesy.

The General Electric Company has placed near each telephone throughout its entire plant a little card reading as follows:

Worth Remembering.

Many a man has dug his grave with his tongue.

The manner in which you use a telephone indicates largely what you are.

Discourtesy hurts the person who uses it more than the person to whom it is directed.

One discourteous act by you over the telephone does an injury to every man whose name is on the pay roll; and a place on the pay roll beats one in the bread line.

It is not always what a man knows; it is what he does that counts. Opportunity plays no favorites.

Knockers do not kill men—they kill business.

Chickens come home to roost; so do harsh words.

Campaign on Tailors' Irons.

Electric irons are being strongly pushed by the Edison Electric Illuminating Company of Boston not only for household use but for use in tailors' shops and clothing houses. A mailing card, 10 by 7 inches shows the sweltering condition under which workmen using irons of types other than electric, work.

The card is printed in two colors, the illustration being in red and the text, in a mortise, being in black.

A Way to Sell Electric-Cooking Service

In the Merchandising of Electric Ranges Service Should Be the Keynote and the Automobile Industry Has Shown That Advertising and Salesmanship Count Far More Than Mere Selling Price

By J. E. Bullard

ABOUT 15 years ago there was placed upon the market a product that was considerably more expensive both in first cost and in operation, that was less reliable and much more troublesome, and that required more experience and greater skill to operate than that which it was destined to displace. The manufacturers of this product, however, had the utmost confidence in it. They both advertised it and improved it. They put forth the most strenuous efforts to popularize it. They succeeded so well that they not only sold enough to keep the factories operating but also provided a profit which was used for enlarging the plants and improving the product. This continued and in a comparatively few years it was possible to greatly reduce the selling prices. These prices have now been reduced to such an extent that this product—the automobile—can be purchased at prices as low as that of a good horse. It is practically within the reach of every one above the day-laborer class. This has all been accomplished in the short space of 15 years.

The results have been so gratifying in the automobile industry that it would seem wise for the electrical industry to study the methods used. Such a study soon develops the fact that automobile manufacturers have never relied upon price alone to sell their product. In fact it would seem that the selling price has in most cases been a secondary consideration. They have placed their reliance upon advertising and aggressive salesmanship. How successful they have been is indicated by the fact that the combined daily output of the two largest factories is considerably in excess of the total number of machines in operation in the year 1899, and a week's output of these two factories is about equal to the total number of cars in operation in 1903.

The early days of the automobile business were not so promising as is the electric-cooking business today. In those days it was not so easy to raise money for the purpose of manufacturing automobiles as it is today. It was necessary to sell practically the total output for cash. Long and easy terms were ordinarily entirely out of the question. Prices were high, the machinery unreliable and troublesome, the industry new. In spite of all these drawbacks persistent and intensive selling methods have brought this industry up into the class of the most important industries in the country.

High First Cost of Ranges Not a Serious Detriment.

Expression is often given to the opinion that the high first cost of electric ranges is a decided detriment to the rapid growth of the electric-cooking industry. Could we ask for anything more rapid than the growth of the automobile industry? In 1899 American manufacturers produced 600 cars, in 1910 they produced 200,000 cars and today a concern that does not turn out 600 to 1,000 cars per day is not considered a quantity producer. Has the high first cost of the automobile been a very decided detriment to its popular adoption?

When the electric man suggests that electric ranges be sold for less than cost, that is, the total cost including selling, installing and credit costs, he figures on making up the loss from the energy sold. Automobile manufacturers have never been able to persuade oil companies to sell automobiles for less than cost in order to increase the sale of oil and with the idea of making up the loss on the price of the oil. If it had been done isn't there a possibility that many people would have purchased machines without figuring the cost of operation, that this cost would have been greater than it actually is on account of the higher price of oils, and that there would not be as many automobiles in operation today as there actually is? Automobile manufacturers paid little attention to finding the easiest way to sell their output. They looked for the best way. They pinned their faith to extensive advertising and high grade salesmanship and today every one who does not already own a car is fondly looking forward to the day when he will own one. One of the surest ways to excite suspicion in regard to one's integrity is to make the statement that he never wants to own an automobile.

Automobile Industry Has Shattered Low-Price Theory.

The automobile business has done its share to shatter the theory that low prices alone will successfully sell goods. Possibly a more conclusive proof that this theory is false, however, is to be found in the department-store business. The department-store business as a class has been established and has grown to its present size on the low-price theory or the bargain idea. In a recent issue of *Printers' Ink* the editor draws attention to the fact that department stores are losing ground. He reminds the reader that many of them are actually going out of business and that very few of them are making the progress that the increase in population indicates they should make. He shows that on the other hand specialty stores, stores that lay more stress upon service than upon price, stores especially that confine themselves largely to nationally advertised products, are making greater progress than ever. The moral he draws is that advertising and salesmanship count far more than the mere selling price.

Cooking Service is the Commodity Sold.

In the electric-cooking field that which we most desire to sell is not so much appliances as the cooking service. It matters not at what price the range is sold if it does not result in the satisfactory adoption of electric cooking its sale has not proven profitable to any one concerned. Until the service can actually be sold, until the range owner can be persuaded that electric cooking is the best cooking and in the final analysis the most economical cooking, the sale of electric cooking appliances will not increase to the satisfaction of the manufacturer, the dealer or the central station.

It, therefore, is evident that the selling and the advertising effort must be concentrated upon the electric-cooking idea rather than upon the electric-range idea. In the same way that automobiles are sold for what they will do rather than for what they are, electric ranges must be sold for what they will do rather than for what they are. Electric rates have been made as low in over 3,300 communities as under present conditions it is wise to make them. The service is being sold as cheaply as it can be sold. Since in the final analysis it is the cost of operation rather than the first cost of the appliances that will limit the growth of this business it would seem unwise, to say the least, to burden the revenue from the energy sold with any unnecessary expense.

If the selling methods that have proven so successful

in the automobile business were adapted to the central-station business there is every reason to believe that a very gratifying increase in the cooking load could be made even though ranges were always sold for cash. Under the present condition of the industry, however, such an extreme is not necessary. Most central stations and a great many dealers are abundantly able to offer long terms and sell cooking appliances in much the same way that phonographs, sewing machines and pianos are sold.

National Electric Cooking Campaign Proposed.

A much more effective method than selling cooking appliances at prices which do not entirely cover the cost would be to considerably increase the selling price, sell them on very easy terms and appropriate a liberal percentage of the sales for use in a national co-operative electric cooking advertising campaign. Such a campaign would sell the cooking idea. It would cause people to really desire to cook with electricity. It would effectively teach the public the many advantages of electric cooking at a cost much less than it could be taught in any other way.

This plan would never prove burdensome to the central station, the dealer or the manufacturer. Since the appropriation would be added to the selling price the consumer would pay the cost just as he paid the cost of introducing the automobile. It would prove far more advantageous to all concerned than the low-price plan. It would prove advantageous to the central station because it would not pile up dead capital charges on which interest would have to be paid and which would tend to keep up the rates charged for current. It would prove advantageous to the manufacturer and the dealer because it would materially increase the sale of cooking appliances and all these appliances would be sold at a satisfactory profit. It would prove advantageous to the consumer because the service rendered by the advertising would be well worth the small increase in the price of the appliances and since every department would be paying its way, lower electric rates would be forthcoming much sooner than would be the case if part of the cost of the appliances had to be paid in the form of the rate for electricity.

There is every reason to believe that such a plan would prove just as profitable to the electric industry as extensive advertising and intensive selling have proven to the automobile industry. It would permit of such quantity production that in the course of the next ten or fifteen years prices could be reduced to such an extent on both appliances and current that the use of electric cooking would become far more universal than would be the case if less intensive and progressive methods were used and part of the cost of introduction was shifted to the future generations in the shape of dead capital used to meet the loss caused by selling appliances below cost.

It is never a wise plan to mortgage the future with the hope of winning an immediate and a temporary advantage unless it is absolutely necessary to do so. In the electric industry we are building for the future. It, therefore, would not be good policy to weaken our present structure by loading it with needless expense. A broad minded view of the situation shows that the price problem is not nearly as serious as many other problems. It surely would be a mistake for a young healthy, rapidly growing industry, one that is full of well educated, energetic, ambitious men to look for an easy way rather than the very best way—the way that will result in the greatest ultimate good to the industry.

During the past century engineering has made wonderful progress. Men now living can remember the time when we did not have many of the accomplishments of the engineer that we now daily see and use. For a decade it has been apparent that it will be necessary to pay a great deal more attention to merchandising and bring that phase of industry up to a higher level if engineering is to maintain the rapid pace it has set. The same principles that have made the engineer so successful must be applied to the sale of his products. The work that has already been done indicates that we will have to look more and more to extensive advertising and intensive selling rather than to the selling price to move goods or sell service.

Boston Edison Pushes Improved Store Lighting.

A striking piece of advertising literature recently issued by the Boston Edison Company in the promotion of better tore and front lighting, is on yellow, light Bristol, 11 by 14 inches, printed on both sides in black and green, the sheet folding to 7 by 3.75, and clipped for mailing, with the written address on the face of the folder.

The folder contains on one side a series of illustrations of well lighted stores and show windows, with text which points out the great advantages enjoyed by the merchant who has a well lighted store over one with shabby, poorly lighted windows and dingy, unattractive interiors.

The other side of the card sets forth graphically the difference between a street having well lighted fronts and electric signs, and one without these illuminating features. "The crowds are on the bright streets," the circular says, and the merchant whose store is effectively front-lighted has a means of procuring business which "works while he sleeps."

Gasoline-Electric Tractors for Street Cleaning in New York.

The New York Street Cleaning Department has purchased 12 gasoline-electric tractors to be used to haul trailers to collect ashes, garbage and street sweepings and to sweep and flush the streets.

The tractors are equipped with a 40-horsepower gasoline engine driving a 15-kilowatt, 125-volt electric generator, whose output operates motors driving the rear wheels.

The total trailer load is 10 tons, the tractors having a test speed of eight miles an hour on level ground. In collecting ashes, etc., each tractor and trailer will carry four men and

Gasoline-Electric Vehicle in New York Street-Cleaning Service.

driver. For street cleaning, the trailers carry a 1,500-gallon water tank equipped with motor-driven pump and rotary broom.

At the dumping dock where the collected material is discharged, electric locomotive cranes are operated to lift the water-tight cans from the trailers to the dumping place, as shown in the illustration.

The vehicles are in service about 18 hours a day, much of the work being performed at night.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Laying Long Submarine Telephone Cables in Massachusetts Waters.

A twelve-conductor telephone cable was recently laid across Vineyard Sound to connect Martha's Vineyard Island with the mainland of Massachusetts, and a six-conductor cable was laid at the same time to connect Martha's Vineyard Island with Nantucket Island, a distance of nearly 20 miles. The latter island was previously without telephone connection.

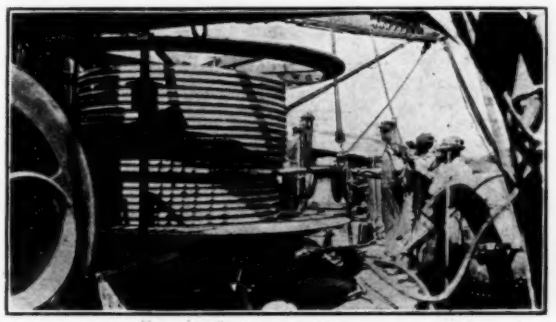
The large size of the Vineyard Sound cable—2.69 inches, and weighing 10.6 pounds per running foot—was necessitated by the strong tides prevalent in that body of water. It is one of the heaviest ever handled by a power, telephone or telegraph company. The Nantucket cable is about five pounds to the foot. In the former cable each conductor is wrapped in double paper insulation, with a similar wrapping on the core, around which is a lead sheath 5/32 inch in diameter. Around this are three layers of 100-pound jute roving bound by 23 No. 6 armor wires 0.203 inch in diameter also inclosed in two layers of jute roving and finally

Paying Out Submarine Cable From the Steamer.

bound in an outer armor of No. 4 steel wires, the final wrapping being of two thicknesses of No. 16 three-ply jute yarns.

The Nantucket cable has double insulation, a lead and tin sheath 5/32 inch thick, and three layers of 100-pound jute roving bound in steel wire armor of 18 strands 0.238 inch in diameter.

The Vineyard Sound cable reached Wood's Hole, the point of departure from the mainland, in four reels, weighing, respectively, 71,400, 71,500, 72,300, and 36,800 pounds, these being among the heaviest reels on record.



Splicing the Cable on the Steamer.

Laying of the cables was done by the Western Union Telegraph Company's cable ship *Clowry*. Reels were mounted on deck and payed out through a pulley block attached to a derrick boom on the steamer.

The landing of the cable was made by the steamer anchoring directly opposite the cable box, which was attached to a large pole 150 feet inshore. A dory was sent inshore with a running line to which was attached a large steel cable. When this was drawn upon the beach a snatch block was rigged, through which the steel cable was passed and then carried back to the steamer. The steamer's winch was then started and the running line, and then the steel cable, were drawn to the boat and the submarine cable then paid out. After about two hours' work the cable was drawn ashore and carried to the box, the 150 feet between the water's edge and the box being a trench in which the submarine cable was buried.

The other end of the cable, which had been sustained on buoys about 4.5 miles off shore, was picked up and spliced to the cable aboard the steamer, which was reeled off with the vessel steaming on her course.

A series of tests was made, first with a telegraph set and then with telephone instruments, the line being found perfectly clear.

The Nantucket cable is the longest electrical conductor under water in the United States. Its total weight is 361 tons.

Contractors Busy in Louisville.

Electrical contractors in Louisville, Ky., are all extremely busy at this time, as a result of the house-wiring campaign of the Louisville Gas & Electric Company and the numerous industrial jobs and commercial work that is being done. If a customer gets attention within three weeks after he has put in his application he is considered fortunate.

Polyphase Motor Windings—X

By Justin Lebovici

Previous installments of this article have dealt with two-layer and single-layer windings, the details of open and closed lap and wave windings being discussed and illustrated and numerical examples worked out. In this installment it is shown how, by changing the number of poles, windings may be adapted to two speeds. In the next installment rotor windings for two-speed induction motors and short-circuited rotor windings will be considered.

INDUCTION-MOTOR WINDINGS TO GIVE TWO SPEEDS BY CHANGING THE NUMBER OF POLES IN THE PRIMARY WINDING.

Three-Phase Windings.

Two speeds can be obtained in induction motors by using two independent windings placed in the same slot, as shown in Fig. 123, where *A* and *B* represent the two windings. Each

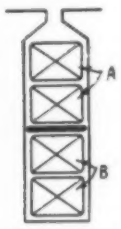


Fig. 123.

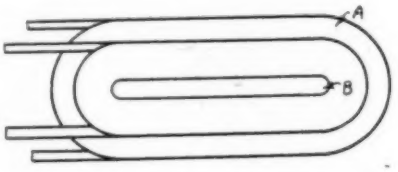


Fig. 124.

winding is shown as a two-layer winding and is wound with a coil pitch corresponding to its number of poles. This method of obtaining two speeds has the following disadvantages: the slots are very deep, which may require a machine of larger outside diameter; half of the primary copper is always idle all the time; the leakage reactance per turn of the winding in the bottom of the slot is greater than for the winding in the top of the slot; the cost of winding or repairing is greater than in other types.

Better results are obtained if the coils of the two independent windings are wound one on top of the other and spread to a coil pitch of a value between the pole pitches corresponding to the two numbers of poles. Such a coil is shown in Fig. 124.

By regrouping the coils, the same winding can be used to give two speeds, but unless these speeds are in the ratio of two to one, the number of leads becomes great and the switching complicated. The following discussion is limited to cases of a speed ratio of two to one.

Fig. 125 represents either two poles of a continuous lap, or a continuous multipolar wave winding, split into six sections, to be connected to form a three-phase winding. The arrow in each arc indicates the polarity of each phase group, and the poles N_1, N_2, and N_3 in each phase interact to produce the combined magnetic pole *N*.

Reversing the polarity of each alternate phase group in Fig. 125 we obtain Fig. 126. The groups 1_s 1_f and 4_s 4_f, for instance, both become north poles. Since it is not possible to

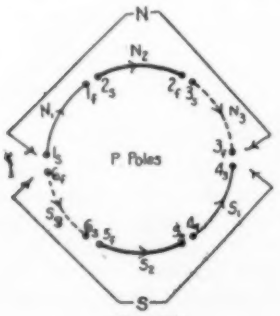


Fig. 125.

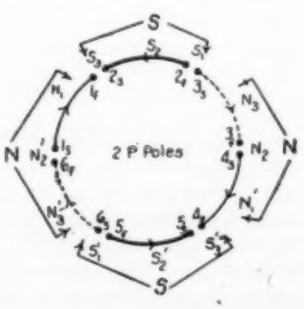


Fig. 126.

Low Speed	2 P Poles	Leads A_1, B_1, C_1	A, B, C Open	Y
High Speed	P Poles	Leads A, B, C	A_1, B_1, C_1 Connected Together	YY

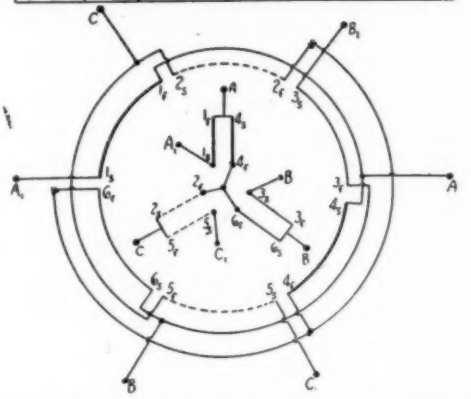


Fig. 127.—Two-Speed, Variable Horsepower Connections.

have north poles N_1 and N'_1 alone, the consequent south poles S_1 and S'_1 immediately appear. Similarly the other two phases produce the poles S_2, S'_2 and N_3, N'_3 with the consequent poles N_2, N'_2 and S_3, S'_3 as can be seen in Fig. 126. All these poles interact to produce the combined magnetic poles *N*, *S*, *N*, *S* as in a normal four-pole machine, and it is at once seen that the connection shown in Fig. 126 gives twice as many poles as Fig. 125.

If the original continuous winding is a multipolar lap winding, we must split each pole pair into six sections, in the case of a three-phase machine. Numbering the sections consecutively $1'_s$ $1'_f$, $2'_s$ $2'_f$, etc., and connecting the first, seventh, thirteenth, etc., section in series and marking the leads of the combined series 1_s and 1_f, we obtain the same representation as in Figs. 125 and 126 and we can apply the same rules to change the speed in a multipolar lap or wave winding.

The change can be accomplished in the simplest manner by using a parallel connection for one number of poles and a series connection for the other number of poles. This is illustrated in Fig. 127. Letting *P* equal the number of poles, then for *P* poles we connect the six sections to form a two-

Low Speed	2 P Poles	Leads A_1, B_1, C_1	A, B, C Open	Δ
High Speed	P Poles	Leads A, B, C	A_1, B_1, C_1 Connected Together	YY

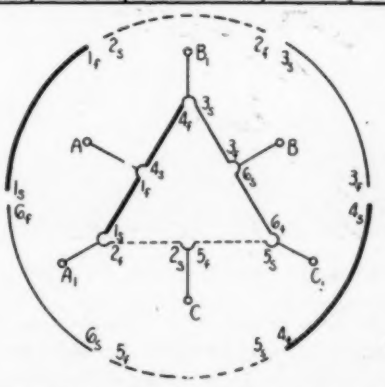


Fig. 128.—Two-Speed, Constant-Horsepower Connections.

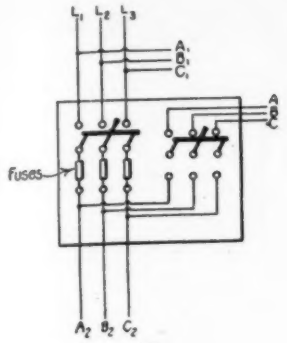


Fig. 129.

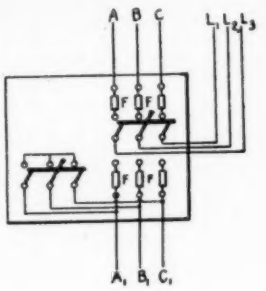


Fig. 130.

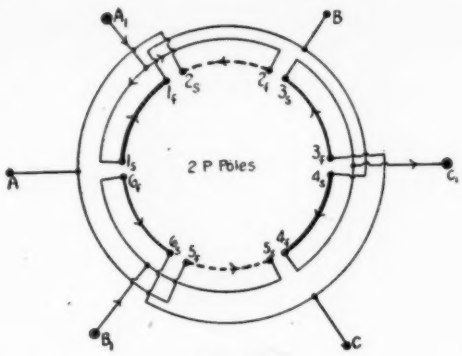


Fig. 133.

circuit star winding, and for $2P$ poles we connect the sections to form a single-circuit star winding. A motor connected as per Fig. 127 gives twice the horsepower at the high speed as at the low speed and is not well suited for machine-tool applications.

The connection shown in Fig. 128 is better suited for constant horsepower and uses a parallel star connection for P poles and a series delta connection for $2P$ poles. The coil pitch is selected between the pole pitch of the smaller and greater number of poles and preferably nearer the pole pitch of the greater number of poles, since the winding-factor of this number of poles is poorer. In Fig. 125 the phases are displaced by 60 electrical degrees, hence the winding-factor

$$f_{wp}=3/\pi=0.955$$

In Fig. 126 the phases are displaced by 120 degrees, hence the winding-factor

$$f_{w2p}=3\sqrt{3}/2\pi=0.83$$

The ratio of the winding-factor on the low speed to that on the high speed is

$$\sqrt{3}/2=0.866$$

or the winding-factor is only 86.6 per cent as good on the low speed as on the high speed. For this reason it is advisable to favor the low speed in selecting the coil pitch.

The change in connections from low to high speed can be accomplished by a triple-pole, double-throw switch, in connection with a triple-pole single-throw switch. Figs. 129 and 130 show the wiring schemes for the connections of Figs. 127 and 128 respectively. Care should be taken when connecting up as in Figs. 129 and 130 that the motor runs in the same direction at both speeds.

It is possible, by suitably connecting the sections, to obtain the change in speed by the use of a triple-pole, double-throw switch only, as shown in Fig. 131. By connecting the line to A, B, C, one speed is obtained and by connecting the line to A_1, B_1, C_1, the other speed is obtained. These connections are shown in Figs. 132 and 133. The winding-factor is 83 per cent for both speeds.

Example No. 48.

A three-phase, 45-slot, 45-coil wave winding is to be connected for four and eight poles, the application requiring the same horsepower at both speeds. We have

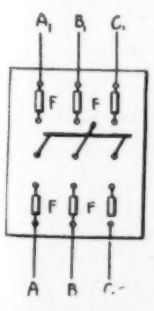


Fig. 131.

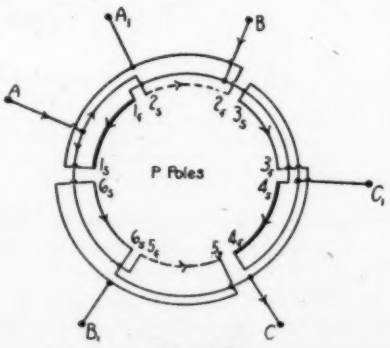


Fig. 132.

$Z=45$ $S=90$ $p_h=2$ $p_1=4$ $n=3$

$Z=2\times22+1=p_h\times22+a$

$Z=3\times15=n\times15$

$\tau_h=90/4=22\frac{1}{2}$

$\tau_1=90/8=11\frac{1}{4}$

$(\tau_h+\tau_1)/2=16.9$

$y_h=y_1+y_2=(S\pm2a)/2=(90\pm2)/2=92/2=46$

We choose $y_1=15$ $y_2=31$

The coil sides in series in each section$=S/6=90/6=15$ and since this would bring the leads on opposite sides of the machine we will place 16 and 14 coil sides, alternately, in each section.

Table XLVIII and Fig. 134 can now be made up. Fig. 134 shows the eight and the four-pole connections.

TABLE XLVIII.

1s (1)	16	47	62
3	18	49	64
5	20	51	66
7	22	53	(68) 1r
2s (9)	24	55	70
11	26	57	72
13	28	59	74
15	(30) 2r	(61) 3s	76
17	32	63	78
19	34	65	80
21	36	67	82
23	(38) 3r	(69) 4s	84
25	40	71	86
27	42	73	88
29	44	75	(90) 4r
5s (31)	46	77	2
33	48	79	4
35	50	81	6
37	52	83	(8) 5r
6s (39)	54	85	10
41	56	87	12
43	58	89	14
45	(60) 6r		

Example No. 49.

A three-phase, 36-slot, 36-coil, lap winding is to be connected for six and twelve poles, the application requiring the same torque at both speeds. We have

$Z=36$ $S=72$ $p_1=6$ $p_h=3$ $n=3$

$\tau_1=72/12=6$ $\tau_h=72/6=12$ $(\tau_h+\tau_1)/2=9$

$y_1=9$ $y_2=7$

As stated before, we connect the first, seventh, etc., groups of coils in series and mark the leads of the resulting groups 1s and 1r, 2s and 2r, etc. We have six sections which can be connected according to the scheme shown in Fig. 127. This is shown in Figs. 135 and 136. The change in the number of poles can be easily seen by noting the direction of the currents as indicated by the arrows.

Two-Phase Windings.

Two-speed, two-phase induction-motor windings can be made by applying the same method as given for the three-

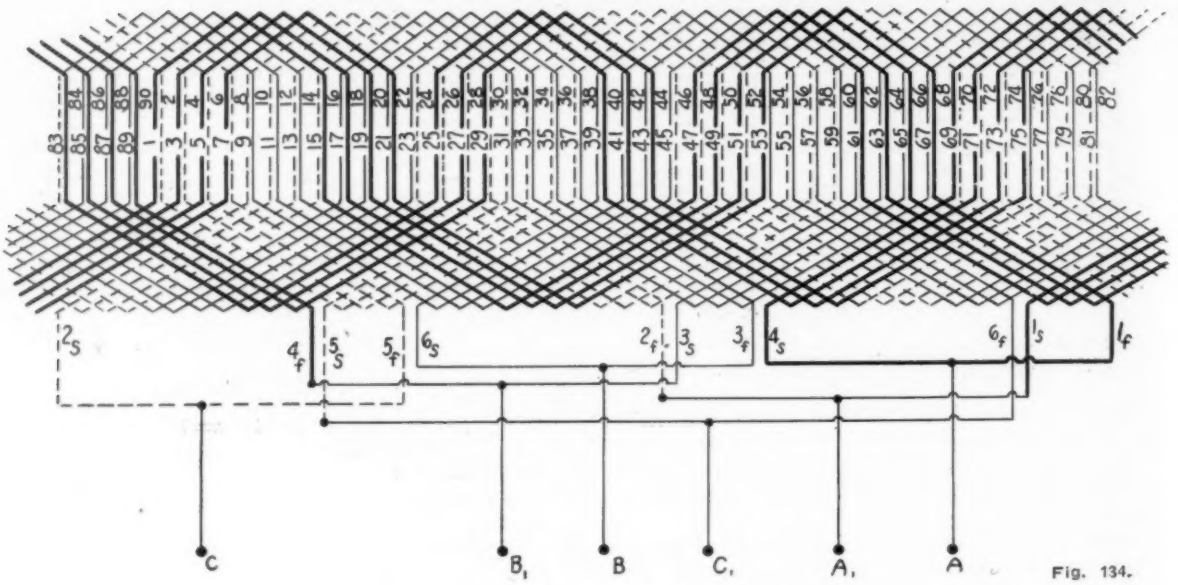


Fig. 134.

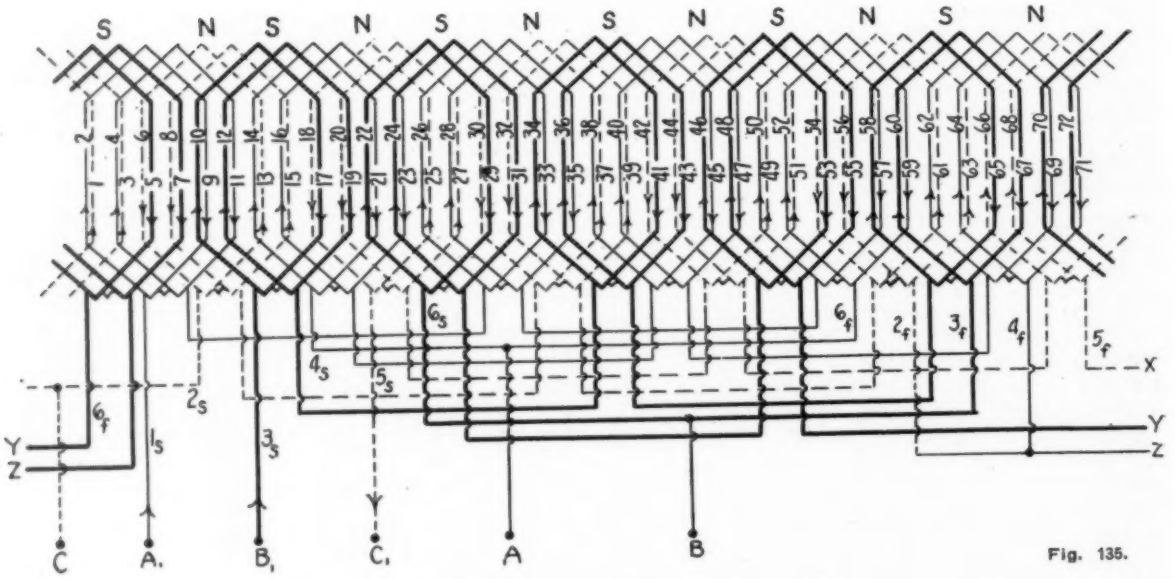


Fig. 135.

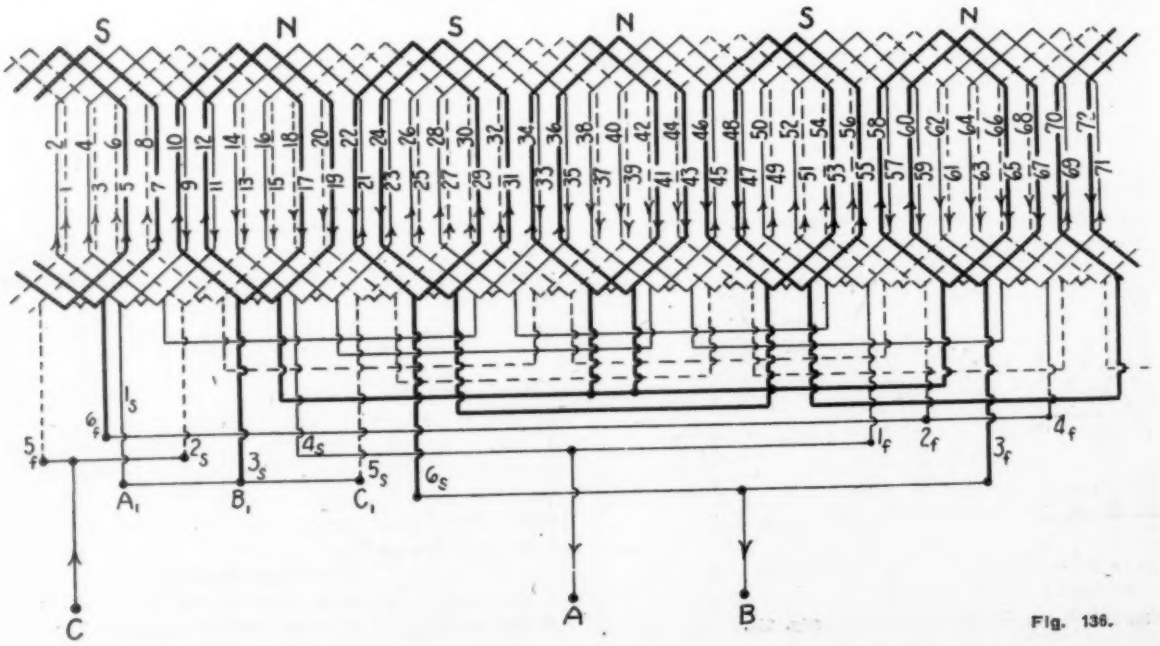


Fig. 136.

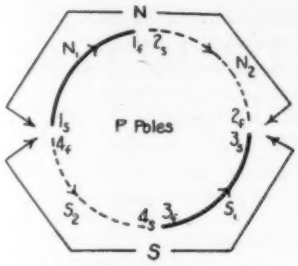


Fig. 137.

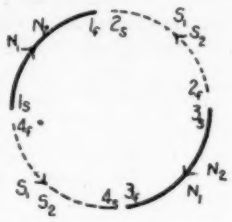


Fig. 138.

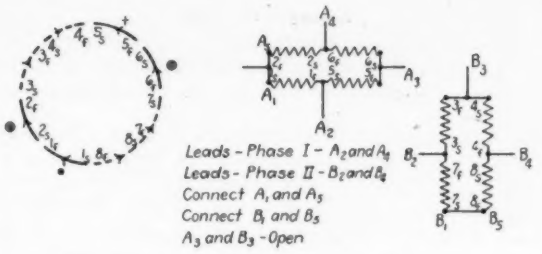


Fig. 142.

Fig. 143.

phase machines. By reversing every alternate phase group in Fig. 137 we change from a P-pole winding to a $2P$-pole winding, as shown in Fig. 138. The leads are marked in the same manner as the three-phase windings.

The change in poles can be effected in the simplest manner by using double plus connections for the high speed and single plus for the low speed, as shown in Figs. 139 and 140.

Low Speed	2 P Poles	Leads A_2, A_3, B_2, B_3	A_1, B_1 Open	+
High Speed	P Poles	Leads $A_1, A_2, A_3, B_1, B_2, B_3$		#

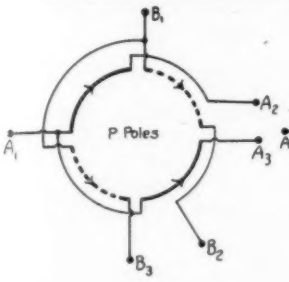


Fig. 139.

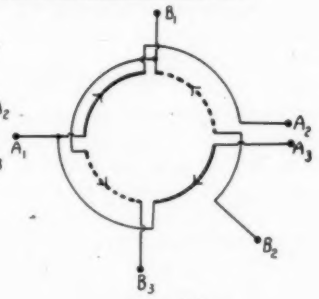


Fig. 140.

The winding-factor for the high-speed winding, shown in Fig. 137, is

$$f_{wp}=2\sqrt{2}/\pi=0.90$$

The winding-factor for the low-speed winding, shown in Fig. 138, is

$$f_{wsp}=2/\pi=0.636.$$

Since the counter electromotive force and the output of a

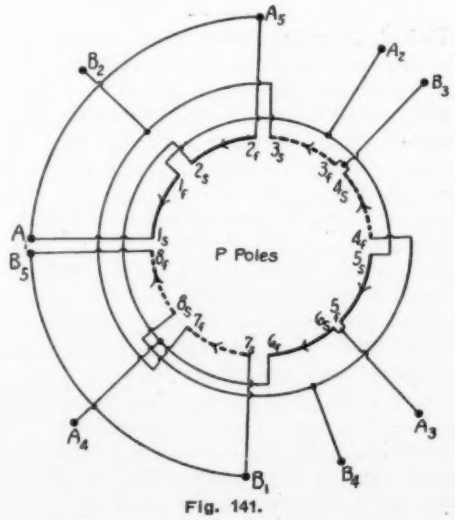


Fig. 141.

machine depend upon the winding-factor, it is seen that the output at the low speed is reduced in the proportion

$$1/\sqrt{2}=0.707$$

and is only 70.7 per cent of the output at the high speed.

By increasing the number of leads brought out from the winding from six to ten, the distribution-factor can be maintained at 90 per cent for both speeds. We use in this scheme a star-connected, two-phase winding. Figs. 141 and 144 show how this result can be obtained. In a wave winding we split the winding into eight sections, marking the ends 1_s and 1_f, etc., as before. In a lap winding we split the total number of

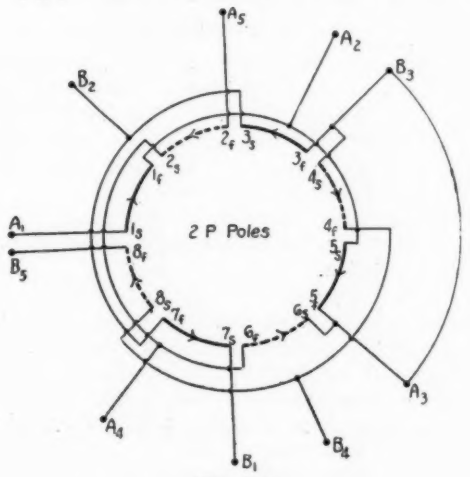


Fig. 144.

coils per pair of poles into eight groups, or the total winding into eight times as many groups as there are pairs of poles, and connect the first group in series with the ninth, the seventeenth, etc., and mark the ends 1_s, 1_f, etc. These leads are then connected as shown in Figs. 141 and 144.

Fig. 145.

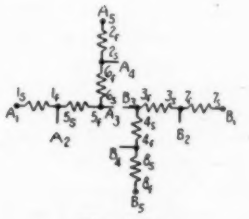


Fig. 146.

Figs. 142 and 145 show winding potential diagrams for Figs. 141 and 144, and show how the phase displacement between groups 1_s, 1_f and 3_s, 3_f changes from quarter-phase in Fig. 141 to in-phase in Fig. 144. Figs. 143 and 146 are another representation of Figs. 141 and 144, and give a clear view of the changes taking place.

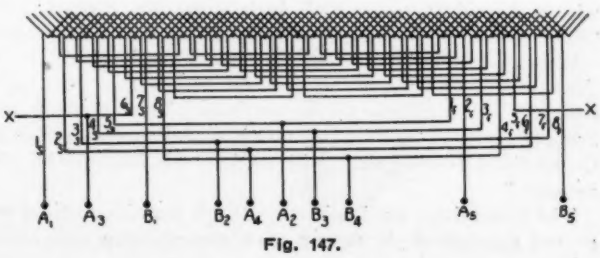


Fig. 147.

Example No. 50.

A two-phase, 64-slot, 64-coil winding is to be connected for 8 and 16 poles. The connections are to be such as will give a good winding-factor at both speeds. We have

$$Z=64 \quad S=128 \quad p_h=4 \quad p_l=8$$
$$\tau_h=128/8=16 \quad \tau_l=128/16=8 \quad (\tau_h+\tau_l)/2=12$$

We choose $y_l=13$ and $y_s=11$, and obtain the progressive winding shown in Fig. 147. The change can be accomplished by the use of a seven-pole, double-throw switch. For high speed connect A_2 and A_4 to line leads of one phase, B_2 and B_4 to line leads of other phase. Connect A_1 to A_3 and B_1 to B_3. For low speed connect A_1 and B_1 to line leads of one phase, A_3 and B_3 to line leads of other phase. Connect A_3 to B_3. Let A_2, B_2, A_4 and B_4 remain open.

(To be continued.)

Massachusetts Electrical Licensing—Its Operation and Prospective Legislation in Connecticut.

At the convention of New England electrical contractors held last week at Hartford, Conn., one of the most important topics discussed was the licensing situation in Massachusetts, and the proposal to enact a similar law in Connecticut. The matter came up in a report on "The Licensing of Electrical Contractors and Operation of the Massachusetts Law," made by J. E. Wilson, of Boston, special representative of the Massachusetts Electrical Contractors' Association.

"A little over a year ago the law was enacted," he said, "and while it was not all that was asked for, much good has resulted. We have compelled a man to be over 18 years old before he can take an examination, have eliminated the five-year experience clause, thus preventing undesirable wiremen from obtaining a license by false statement, and have caused the arrest, with fine, of law evaders and compelled others to take examination and secure a license. Over 200 candidates have failed in examinations and been refused a license, all of whom would have been undesirable competitors and inefficient workmen."

As an indication that the law is now respected, Mr. Wilson said that during the past three months only three complaints have reached him, while prior to that, complaints numbered 20 to 30 per month.

Chief among the changes desired is to have four instead of two classes of licenses: Class A for registered contractors, having regular place of business; A-1, fixture houses and manufacturers; B, regularly employed wire-men; B-1, fixture men doing only that class of work; motion-picture operators and the like.

Mr. Wilson spoke of the reluctance of contractors, in small towns especially, to complain of violations. Letters were read, from leading contractors, who endorsed the law and suggested means of strengthening it.

A report of the Legislative Committee, for work in Massachusetts, was presented by F. L. Barnes, Boston. He said the Massachusetts Association had worked hard to secure amendments to strengthen the present law. It has the valuable co-operation of the labor unions.

Asked what steps should be taken to secure the passage of a licensing law in other states, particularly Connecticut, where there is now no such legislation, Mr. Barnes said: "First, hold a preliminary gathering of all parties interested —labor, insurance, contractors, central stations. Have a 'feed'—always an attraction—and encourage free discussion from all sides. Hold more meetings. Then petition the State Assembly, getting as many signatures as possible. Go to committee hearings with all interests lined up for the measure."

The Committee on Legislative Work for Connecticut reported through A. S. Green, of Westport, who said every contractor should be sure his local representative will vote for the licensing bill. Get his written promise of support. Mr. Green urged members to secure new members of the State Association. He paid a high tribute to the local representatives of the American Federation of Labor for helping in framing the bill which will be presented to the next Connecticut Assembly. He favored a plan by with important changes, however, in many particulars. The spection, with fees.

Electrical Code of New York City.

The Department of Water Supply, Gas and Electricity of the City of New York has issued in book form the New York Electrical Code as amended May 29, 1916. It constitutes Chapter 9 of the Code of Ordinances and consists of seven articles, of which the first and last relate to the general matters of electrical inspection, licensing, etc. In general the numbering of the rules is such that they may be readily compared with the corresponding rules of the National Electrical Code. Their text follows the latter with important changes, however, in many particulars. The city's code is published as a well printed and neatly arranged book of 67 pages of size 6¾ by 10 inches.

Among the Contractors.

The Andrews Electric Company, Brockton, Mass., has reorganized, Arthur H. Andrews, former head of the concern, having sold his interest. The new officers are: President, G. F. Beaton; treasurer and manager, George W. Smith; clerk, E. L. Bouldrey. Arthur B. Spencer is a director, with the above.

H. C. Evans has bought the McKinley Electric Company, Shukert Building, Kansas City, Mo., and is now conducting the business. The company has contracts for wiring the new girls' reformatory located in Jackson County, Mo., and wiring the additions to the Sexton Hotel in Kansas City.

Emile Andrews has leased quarters in the Exposition Building, Sonoma, Cal., and is putting in a stock of electrical fixtures and supplies.

The United Electric Construction Company, Philadelphia, Pa., has been awarded contracts totaling $100,000 for electrical work in the following structures: Office building, Girard Street, Philadelphia, for N. Snellenburg; bank building, Franklin Trust Company, South Fifteenth Street, Philadelphia; factory, Bridgeton Metal Goods Company, Bridgeton, N. J.; factory, Ringwalt Linoleum Works, New Brunswick, N. J.; and John K. Stewart buildings, Long Island City, N. Y.

The Harry I. Wood Company, Louisville, Ky., is wiring the plant of the Louisville Veneer Company, for the installation of 15 440-volt, alternating-current motors, ranging in capacity from 5 to 75 horsepower. This is an electrification of a formerly steam-driven plant. The motors are Allis-Chalmers, part of them direct-connected and all for individual drive. Another contract the Wood company is working on includes installation of 14 motors and a motor-generator set in the plant of the Louisville Lead & Color Company. The generator set will supply the motors which operate the 12 freight elevators.

The Home Electric Company, with H. W. Guilbert and W. J. Shackelford as managers, has moved into its new location in the First National Bank Building, Concordia, Kans.

DOLLAR WIRING KINKS

Every reader is invited to contribute to this page. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

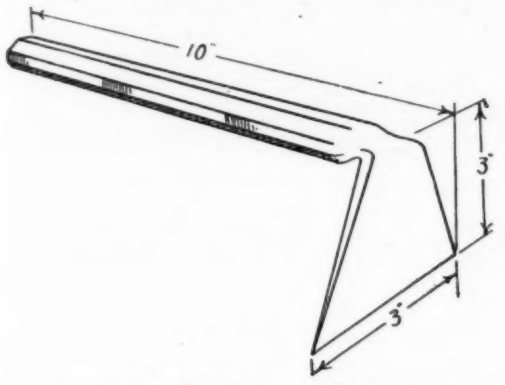
Easy Method for Drilling Tile.

Anyone that has ever experienced difficulty in drilling glazed tile in order to hang fans or brackets on walls, will find that such holes can be very easily and quickly drilled by first taking a small one-quarter-inch chisel and chipping off the glazed surface about the hole. Then grind the drill to a very blunt point using water as a wash. Then drill the tile slowly to prevent cracking it.

Walter Morris.

Electrician's Floor Chisel.

The accompanying sketch shows a floor chisel which is particularly useful in taking up floors when wiring finished buildings. Its chief advantage over the ordinary straight chisel is the ease with which it can be used in close quarters, especially in taking up a board whose grooved side



Steel Floor Chisel for the Inside Wireman.

is very near the baseboard, which is done with difficulty by ordinary chisels.

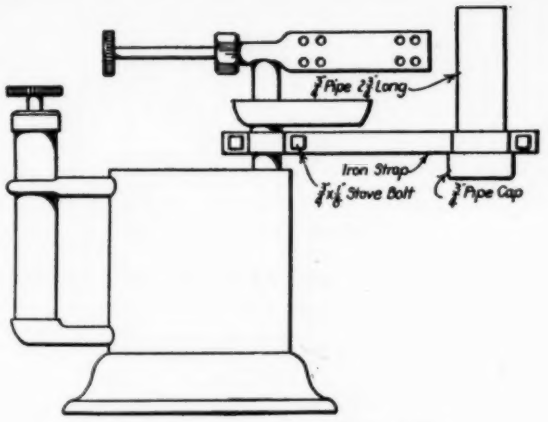
This floor chisel can be made from 5/8-inch tool steel by a blacksmith, or the wireman himself, if he is familiar with forge work. A piece about 16 inches long of octagon bar tool steel is required, as it is necessary first to upset or thicken the end so as to have the stock large enough to flatten to the required width.

H. L. Spicer.

Torch Attachment for Soldering Rat-tail Joints.

In soldering rat-tail joints I have found it very convenient to fit a simple device on the torch. It consists of a piece of 0.75-inch iron pipe, 2.75 inches long, threaded on one end, to which is screwed an iron cap. It is then fitted with a perforated iron strap which is bent to fit the piece of pipe and has the two ends bent to fit the pipe under the gasoline trough of the torch. One stove bolt is used up close to the 0.75-inch pipe and two are used on the torch pipe. A pint or a quart torch can be used. The strap is made long enough to clear the torch burner by about 1.5 inches; this will allow straight or union splices to be soldered between the pipe and end of torch burner.

When this pipe is finished, it is filled up with solder. When melted the joints are dipped into this, thus soldering the joints quickly and without burning the insulation of the wire. It also eliminates the smoke, so it can be used



Solder Holder for Mounting on Torch.

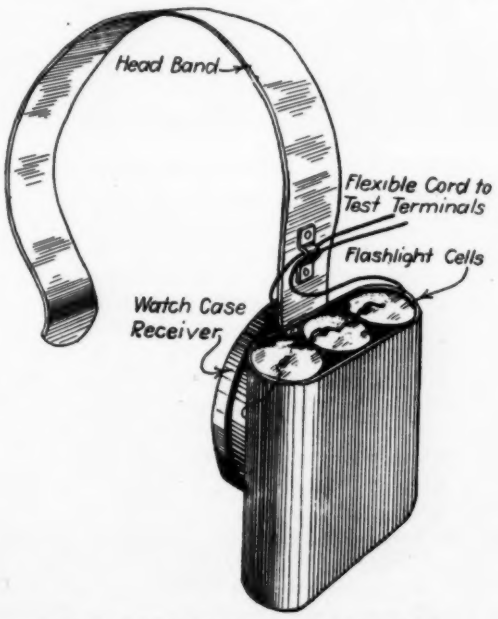
for fixture work on clean ceilings, the torch, of course, being turned out in this case. For soldering joints on big jobs in conduit work it has no equal, as the rat-tail splices come out of the outlet box and are readily soldered.

Benjamin Swanson.

Convenient Testing Set.

A handy testing outfit to take the place of the cumbersome magneto in testing wiring circuits before covering them up and for similar purposes is shown in the diagram herewith. It consists of three small dry cells, such as used in flashlight sets, mounted with a watch-case telephone receiver on a head band like the kind used by telephone operators or wire chiefs. The three cells are connected in series and in series with the receiver. A flexible cord runs to the test terminals, which should be kept apart when not in use to keep the cells from running down. Connections to the receiver can be made at the binding posts on the back of the receiver. A small clamp should be riveted to the head band above the battery to hold the flexible cord. When testing with this outfit a click heard in the receiver shows the circuit tested to be closed; failure to get a click indicates an open circuit. This outfit can also be used by telephone trouble men to call and talk to central, where metallic circuits are used in a magneto exchange.

H. W. Dutton.



Self-Contained Head Set for Testing Work.

THE DEALER AND STOREKEEPER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Store-Keeping for the Dealer in Electrical Goods

LARGE JOBBING HOUSE IN WORCESTER HAS ATTRACTIVE LAMP STUDIOS.

A Description of the Coghlin Electric Company's Quarters, Salesrooms and Lighting-Fixture Stock.

An electrical jobbing and contracting house, located in a city of medium size, but having as its territory a large part of New England, is the Coghlin Electric Company, Worcester, Mass. Though only about 40 miles from Boston, this firm enjoys a line of trade which extends over Vermont, New Hampshire, Connecticut and Western and Central Massachusetts, while it also does a considerable amount of business in the Dominion of Canada. The advantages which a firm so located has in the matter of freight rates, and in lower rental and overhead costs, more than compensate for the fact that it is located outside a large metropolitan center. In some cases, a house located thus is at a considerable advantage, with respect to wages paid employees, over the firms in the larger centers. The Coghlin company employs about 100 men, a large proportion of whom are engaged in making lighting and power installations at a distance from Worcester. Its floor space amounts

Coghlin Electric Company's Appliance Room.

to 45,000 square feet, and it carries one of the largest stocks of lighting fixtures in the eastern part of the country.

The store, at 259 Main Street, consists of two floors and a basement. The salesroom is on the first floor, with private offices and stock sales department at the rear. A large glass-fronted cabinet occupies a position at the wall to the right of the entrance; on the left is another glass cabinet, also containing household appliances, with lamps or fans on the top of each. Tables in the center of the floor carry seasonable goods, while on the floor itself are arranged the larger electrical household devices.

At the far end of the store is a desk for the conduct of retail business, and at one side two counters for the sale of lamps, switches, outlets, and other smaller accessories.

A wide stairway leads to the second floor, where are located the lamp studios, the workshops, and storerooms.

The fixture studios are noteworthy for the elaborate and tasteful collection of fixtures and lamps of various grades, many of the units being the height of elegance and beauty. One room is specially set apart for Colonial patterns, another for early French types, and another for iron and hammered fixtures.

A View in the Colonial Room.

At the present time a large stock of silk shades is carried, this type being in great demand. Mahogany and gold standards are predominant in standing and table lamps, reflecting the general favor in which these types are held. A large number of table, hanging and floor-standing lamps are connected with lighting circuits and are available for examination lighted, as in the home. The usual wall construction of panelled burlap, divided vertically by white wooden strips, lends itself favorably to the display of wall brackets, of which there is a very elaborate exhibit.

The company's advertising, in connection with the retail end of the business, is mainly in the daily newspapers. It employs a force of salesmen who cover the territory outside the city in a systematic manner.

Display of Hammered and Stamped Fixtures.

Business Hints for the Electrical Dealer

The Successful Handling of Complaints—Opportunities in the Automobile-Lamp Business—Turn-Over and Overhead Expense—Practical Training of Salesmen—Distribution of Advertising Literature

By G. D. Crain, Jr.

THE suggestion that complaints may be handled "successfully" may not coincide with the ideas of electrical dealers on this subject, and some members of the trade may be of the opinion that complaints are an unmixed evil, to be disposed of as quickly and with as little trouble as possible. But when one stops to remember that business men in many lines actually solicit complaints from their customers for the purpose of finding out the weak spot in the conduct of their establishments, the possibilities of the proper handling of complaints are more evident.

A customer who comes in with a kick and is dealt with diplomatically is like the people whom Goldsmith wrote about, who came to scoff and remained to pray. This sort of customer will become the strongest kind of booster, and will be a positive aid in the development of new business. If the store has no system for looking into complaints, but dodges just as much as possible, and shifts the responsibility as much as possible, the effect will be just the reverse. This is not to say that the customer is always right—because in a lot of cases he isn't. It may often be good policy, however, when the patron is sincere and honest in his belief that he is entitled to an adjustment to handle the complaint with his interests chiefly in view.

The writer recently watched a clever salesman in an electrical store take care of a customer who came in with a tale of woe about a flashlight that had gone wrong. The customer had taken it on a camping expedition, and while he said that he had not used it personally and could not tell what had been the conditions, he knew that the period covered was not more than two weeks. The customer, a man of middle age, did not appear to be irritated, but made a reasonable, moderate statement of his case, apparently putting it up to the salesman to decide what should be done.

The latter first inspected the lamp and found that the battery was dead. Then he examined it, and discovered that it was badly rusted, indicating that it had been left out in the rain or badly treated in some other way. The customer realized that this was true, and nodded his head in agreement. The salesman put in the new battery and said, "Fifty cents, please," without raising any question about the payment. The customer handed out the money and departed.

"This was a case," said the salesman later, "where the fault was evidently that of the user. Yet this customer was so inclined to be fair that we would have gone far out of our way to hold his good-will by the right kind of treatment, even better treatment than he might actually have been entitled to. But sometimes people come in with blood in their eye, determined to get a new piece of goods, and refuse to listen to an explanation which may indicate that the fault is theirs. They are determined to have their own way, and there is no advantage in yielding. It is an interesting game, involving a study of human nature."

And, by the way, no kind of selling work gets very far away from that feature, and the man who can size up his customers and adapt his solicitation to their personal peculiarities is very sure to succeed.

Automobile Lamp Business.

An automobilist walked into a big motor accessory and supply store the other day and asked for a lamp of certain specifications.

"We are not carrying lamps any more," was the reply of the salesman. "You can get them, though, at the Blank Electric Company."

This incident may or may not be typical, but it is interesting, at all events, in indicating that the automobile supply people have realized the technical character of the electrical accessory trade, and are inclined to let those in the electrical business take care of it.

Selling the right kind of lamps for automobiles is not as easy as handing package groceries over a counter, and expert knowledge, not only of the lamps but of the cars, is needed. Of course, the lamp manufacturers supply charts indicating the character of lamp needed for each model of every make, but here comes the practical proposition of carrying a complete stock. The automobile supply man may not feel equal to the task of keeping his lamp stock complete, while a concern which is definitely in the electrical business and is handling a full line of lamps anyway can take care of the requirements rather easily.

Automobile dealers are recognizing more and more the danger of inefficient service, and are therefore making way for the specialist, especially the man who knows how to take care of the electrical equipment. The exclusive storage-battery concern is making a success, and the concern able to solve all the problems pertaining to wiring and ignition, which are the most important features in the operation of a gasoline motor car, seldom has any trouble getting business.

In communities where the electrical trade is not getting the business of this character, which develops from automobiles, the dealers will profit by watching for opportunities along this line.

The Matter of Turn-Over

The two most important features connected with the successful operation of any kind of merchandising business are taking care of overhead and speeding up the turnover. The one has to do with the control of expenses and the other with the development of profits.

Incidentally, any discussion of turn-over constitutes the best possible argument for aggressive sales work. The man who realizes that his profits depend on his making his capital and credit work at greatest efficiency, and not allowing merchandise to lie dead on his shelves, is going to keep hustling and keep working for business; and the result of efforts of this kind will be to raise his rate of turn-over, and increase his net profits to the maximum.

Indicating how closely related are the two elements of turn-over and overhead it is obvious that increasing the volume of business without increasing the expenses will reduce the percentage of overhead expense. The aggressive merchant, who creates business instead of being content to let it come to him, not only profits from the direct sales and the increase of his turn-over, but adds to his net gain through his reduced overhead expense. Such a plan has uncounted possibilities.

In the electrical business, a turn-over of four times a

year is generally considered to represent the results of good management in sales work. That is to say, a dealer with a stock worth $3,000 should be able to do $12,000 of business a year. If he is doing less than that, he ought not to be satisfied; if he is doing more, he has the satisfaction of knowing that his efforts are meeting with success and that he is working along the right lines.

The Practical Salesman.

The best salesman in the employ of a large electrical house in an Ohio Valley city came up from the ranks. He started out 15 years ago as an electrician's helper in a factory. He learned a great deal there, and later on accepted a position with a central-station company. After several years' experience in the operating end, he decided that the commercial field offered greater opportunities, and took hold of this department for a small central station. He went up rapidly in this field, and is now handling sales of current-consuming devices for one of the most successful concerns in the country.

The reason he has been able to do so well in sales work is that he knows. He has had the practical end of the work, and he understands just what every piece of electrical apparatus ought to do and how it ought to do it. He can talk electrical goods because he is thoroughly familiar with them, and the consumer who is interested in all of the construction features always gets an interesting and intelligent explanation.

Not every salesman has the advantage of a practical training such as fell to the lot of this man, though such a training would unquestionably be of benefit to everybody who is in electrical sales work. The dealer who is employing a number of bright boys in his shop or in wiring crews may find that some of them have the ability to become salesmen, and, if so, they will be of greatest usefulness because of the solid foundation of practical knowledge which has been laid.

A Rack for Literature.

Dealers are generally alive to the value of the advertising literature they receive from manufacturers whose goods they handle, and most of them make a real effort to distribute the literature so that it will do the most good. However, no one can look around an electrical store without realizing that much of this material is being wasted. Some of it gets very dusty and dirty, so that it is quite unattractive to the customer, and more is thrown on the floor or used to scribble on.

About the simplest plan to use in connection with this literature is to provide a rack containing spaces of various sizes so as to accommodate matter of different dimensions. This rack should be placed in some conspicuous part of the store, where it will attract the attention of customers. A card should be put over it, inviting patrons to help themselves to the booklets and folders. A plan of this kind protects the advertising from dust and dirt, and at the same time means that it can be distributed with less effort on the part of the dealer and his salesmen. The value of such booklets neatly and invitingly placed at the disposal of customers is in stimulating interest in appliances and thereby bringing the customer back to the store to make further inquiries which lead to sales.

Effective Newspaper Advertising of Electric Fixtures.

One of the most systematic and successful advertisers of electric fixtures is the McKenney & Waterbury Company, Boston, Mass., which uses the daily newspapers extensively in exploiting its very large stocks of lamps, fixtures and fittings. The usual space occupied is a 4.5-inch double column, with uniform headpiece design of table and pendent lamps, with the catch-phrase "We Light the World."

One of the company's recent advertisement features is its fall opening display, with the Even-lite as a special feature. This unit, which is termed the "Twentieth Century Fixture," consists of an inverted glass bowl, the outside being opalescent and the inside polished, the effect being to throw the light on the ceiling and at the same time diffuse the light downwards and outwards through the bowl in such a manner as to produce soft light effects in the room and reduce eye strain to a minimum.

The concern carries about 700 styles of fixtures of all types, principally electric, the collection filling 12 floors. It is said to be the largest and most complete stock in the country.

The accompanying illustrations show two recent advertisements run by this company in Boston daily papers and which are responsible for a large amount of business secured.

WE LIGHT THE WORLD
700 STYLES
The immensity, variety and beauty of the McKenney & Waterbury Co.'s display of
ELECTRIC, GAS AND OIL
TABLE LAMPS
in every style and period, can only be appreciated by a journey through their exhibition rooms with lamps lighted to show desired effects. It is truly a wonderful exhibit, surpassing any in the country.
Prices the Lowest, Quality the Highest
Catalogue and Prices on Application
McKENNEY & WATERBURY CO.
Designers and Manufacturers
181 Franklin St., Cor. Congress, Boston, Mass.

WE LIGHT THE WORLD
GRAND FALL OPENING DISPLAY
of the Newest and Best Ideas in
Electric, Gas and Oil Fixtures
This magnificent collection of lighting fixtures fills twelve floors and offers the buyer the largest and most comprehensive stock in the country to select from. Prices the lowest for quality fixtures.
See the Wonderful New
EVEN-LITE
The 20th Century Fixture
Catalogue and Prices on Application
McKenney & Waterbury Co.
Designers and Manufacturers
181 Franklin St., Cor. Congress, Boston, Mass.

Two Newspaper Advertisements of a Boston Fixture House Which Resulted in a Large Volume of Business in the Specialties Advertised.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 360.—Meter Troubles From Lighting.—We have been put to some expense and trouble on small two-wire direct-current meters through lightning striking our direct-current overhead lines and going into these meters. We would like to know whether there is any approved provision for taking care of lightning on such direct-current lines and what experience other central stations have had in this matter.—W. J. A., New Orleans, La.

No. 364.—Predetermination of Flood-Lighting Equipment.—Is there any simple rule or formula for determining in advance what size and number of projectors to use for flood lighting a given area? To take a specific problem, it is desired to flood light a football field from the extreme top corners of an open grand stand, which is 160 feet long and 30 feet high, the corners to be used being 60 feet from the near edge of the field. In this case, what projector equipment can be reasonably determined as being the most economical without several trial installations?—C. A. C., Madison, Wis.

No. 365.—Noise on Telephone System.—A small private telephone plant with 75 telephones is used for a credit system for charge accounts in a large store. It is operated on a small 55-volt generator. Usually there is very aggravating noise on the lines, being at times so great that it sounds as if there were insects fluttering in the head receivers. What is the cause of this? Could it be overcome by installing a storage battery? If so, how many cells would be required and how should they be best charged from 110 volts direct current?—J. S. B., Chicago, Ill.

No. 366.—Unloaders for Electrically Driven Air Compressors.—What types of unloaders are available for electrically driven air compressors to prevent severe load fluctuations?—S. E. M., Chicago, Ill.

Answers.

No. 355.—Special Lighting Districts.—In what states, if any, is it possible to form lighting districts for the special purpose of providing more liberal or more ornamental street lighting by special assessment of all the property owners along the streets so lighted? What procedure is followed in organizing such a district? How does the plan work out in districts already established?—S. G., Yonkers, N. Y.

While the writer was commercial agent of the Utah Power & Light Company, our experience with voluntary lighting improvement districts was so unsatisfactory that he urged the passage of a law creating lighting improvement districts along substantially the same plan by which other special improvements, such as paving, sidewalks, curbs and gutters, etc., are made. In the Utah Legislature of 1913 a bill was passed by both houses to accomplish this, but was vetoed by the governor on the ground that certain features of the bill did not harmonize with other laws on the statute books with reference to special assessments. The bill was revised to overcome these objections and was passed by both houses in the 1915 Legislature and was approved by the governor.

The first two lighting districts in Salt Lake City, known as Lighting Improvement Districts Nos. 1 and 2, have been created. District No. 1 provided for the installation of a four-ampere luminous arc lamp on an ornamental bracket on each trolley pole on both sides of the street. It covered 16 city blocks or approximately two and one-half miles of street, and provided for the operation of approximately 218 lamps under the system. All of the legal procedure necessary under this district has been completed, the system is installed and in operation and no difficulty has been encountered in any way in the application of the law. Although the law does not require it, over 50 per cent of the property owners in practically every block covered had petitioned to have the system installed. The law specifies that more than 50 per cent must protest in order to defeat the improvement. It was found that it was easier to get signatures under this law than it had been under the voluntary systems because all of the signers knew that, in case the system were installed, all of the property owners who benefited should bear their proportional burden of the expense, whereas under the previous systems only the more progressive property owners had signed and paid while the others had gotten as much benefit out of it as they.

Lighting Improvement District No. 2 provides for a far more elaborate system. This provides for the installation of three special inverted luminous arc lamps on each trolley pole, these lamps being supported by an ornamental standard which fits over the trolley pole and completely conceals it. It covers the five principal blocks on Main Street. There are 42 arc lamps per block of 660 feet in length. The legal procedure in connection with this district has all been completed.

The cost of installation is $4.12 per front foot, which is assessed against the property owners and the annual cost of operation will be approximately $1.30 per front foot. Although this is a rather expensive system, less difficulty was found in securing the signatures of practically 50 per cent of the property owners for the improvement than had been experienced previously under the voluntary assessment plan for much cheaper systems.

[This new system is described and illustrated in more detail on pages 626 and 627 of this issue.]

The law is known as Chapter 84, Laws of Utah, 1915.—B. W. M., Salt Lake City, Utah.

No. 363.—Storage-Battery Auxiliary for Small Central Station.—I should appreciate information relative to the advantages arising from the use of storage batteries in connection with dynamos in a small central station. Also what actual saving is effected by this practice? The station in question gives 110-volt day and night service to a small town and at peak delivers about 230 kilowatts. The load is about 200 amperes between midnight and 5 a. m., then rising to about 1,000 amperes at 9 a. m., at which it varies but little until 2:30 p. m., when it rises steadily to a peak load of 2,100 amperes at 5:30 p. m. At 6:30 p. m., it begins to fall gradually until at 9:30 p. m. the demand is about 1,200 amperes, declining very quickly from then on to midnight when it is about 200 amperes.—W. B., Wilkinsburg, Pa.

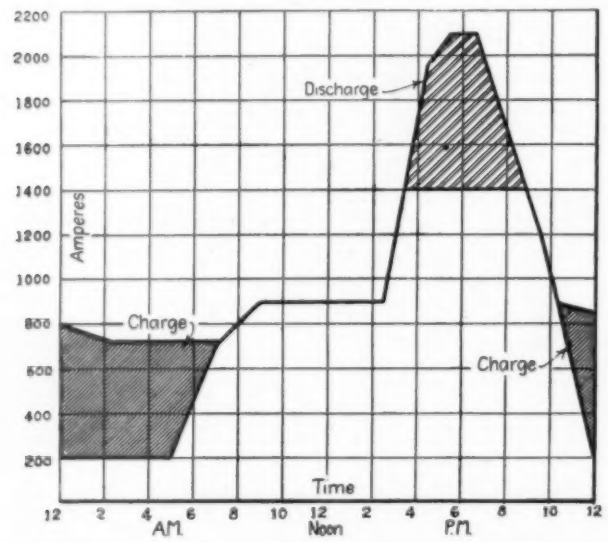
A battery may be installed for any of the following reasons: to assure continuity of service; to assist carrying the peak load and thereby permit of smaller generating capacity; to enable better voltage regulation; to reduce the investment in copper (when a battery is installed out of the line, really a variety of voltage regulation); to reduce operating expenses. For a system of the size of that under consideration it is very doubtful whether the demands by the service requirements would justify the installation of a storage battery as insurance against interruptions to service or to better the voltage regulation. The reason for such an installation would therefore be to reduce operating charges.

By means of a storage battery operating charges may be lowered on such a system by lowering the cost of fuel alone, or by reducing the cost for fuel and labor, depending upon the use to which the battery is put. The most advantageous method of operating can only be determined by trial, that is, by determing the relative saving, if any, by the two ways of operating. Whether there is any saving possible due to the use of a battery depends upon the cost of fuel, cost of the battery (including interest on the investment and depreciation on battery, control apparatus and building, cost of losses in the battery, etc.).

A load curve has been plotted that represents the facts as stated by querist, and upon this load curve one of the two more apparent methods of using a battery is outlined. This first method is to use the battery to assist over the peak load. To do this it would be necessary to charge the battery during

the night or between 11, before midnight, and about 6 in the morning. By doing this the load-factor of the generators, boilers, etc., would be improved, and thus the steam consumption per kilowatt-hour reduced. The labor costs would be about the same. Another way to operate would be to carry the entire night load of 200 amperes on the storage battery, from 12 midnight to 5 in the morning. The plant could then be shut down during the major portion of the night, except for an attendant or two to watch the fires that are banked, attend to blown fuses, etc., blow down boilers and do general repair work. This method of operating would tend to effect a saving in fuel in two ways, namely, by enabling the plant to be shut down during the light night load when the steam consumption is probably far from economical, and by improving the load-factor during the day when the battery is on charge and in this manner permitting of more economical steam consumption. The cost of labor would likewise be reduced.

The only way to determine whether the installation of a battery is financially beneficial is to calculate the cost of operation at present and with a battery operated in the two ways proposed. To do this it is necessary to know the number of generators, engines, boilers, etc., in service at any and all times, their efficiencies at each load and the duration at which they operate at each. From this the steam consumption is obtained for the various periods of the day. This should be converted



No. 363.—Load Curve Showing How Storage Battery Can Improve Load-Factor.

to dollars. The next step is to select a battery with sufficient capacity for the work it is to do. Both methods of operating should, of course, be investigated. The cost of the losses in the battery, together with depreciation and interest on the investment in battery, end-cell switches and control and indicating apparatus, building, etc., have to be added for the day's operation and balanced against the saving due to absence of banked fires, better steam consumption, and possibly reduced fixed charges due to smaller generating capacity. If the two balance, there is a slight advantage in favor of the battery, because of the ability to use it at some time to carry the complete station load; if there is a saving chargeable to the use of a battery, its use is clearly indicated.

Knowing absolutely nothing about the plant, number or type of machines, etc., it would be ridiculous to attempt to make an estimate as to the saving effected by a storage battery. The advantages of such an installation have, however, already been pointed out, and a few hints as to the mode of procedure in determining the capacity of battery may be of service. As capacity in generating apparatus already exists for carrying the peak load the battery would be installed, presumably, to better the load-factor and thus permit the generating apparatus, whether of steam or electricity, to be operated at its highest efficiency.

To select a battery capable of carrying part of the peak load.—A battery for central-station service is usually rated upon an eight-hour basis, with ratings at six, three or one hour being also given. The capacity of a battery decreases as the rate of discharge increases, the capacity being about 93 per cent of the eight-hour capacity at the six-hour rate, 75 per cent for the three-hour rate and 50 per cent for the one-hour rate. A battery is usually charged at the eight-hour rate. Rapid charge is not advisable, as the plates may be damaged, and is far more injurious than a rapid discharge rate. Rapid charging may be resorted to occasionally, provided normal rate of charge is reverted to directly the battery begins to gas. The various charge rates are specified by the manufacturers.

Suppose a battery having a discharge capacity of 600 amperes (for eight hours) is selected tentatively, to be used to assist the station over the peak. This battery is known as a 4,800-ampere-hour battery on the eight-hour basis, the capacity at six hours being about 4,500 ampere-hours and the one-hour rating about 2,400 ampere-hours. The load carried by the battery is probably equivalent to about 4,500 ampere-hours, or slightly over 700 amperes for six hours. The demand is actually less than this, if the load does not exceed that of the load curve. Ten per cent excess battery capacity should be installed in any case to allow for deterioration, etc. As about 4,500 ampere-hours are taken from the battery the same number plus losses in the battery must be put in. A good time to start doing this would be at 10:30 p. m., when the heavy evening load is dropping off. Steam is then up and if the battery is then put on charge the expense of banking the fires under some of the boilers may be eliminated. A high charging rate may be used at the commencement of the charge, because ample steam is available, and normal charge resorted to as the supply of steam drops. The much lower charge rate during the night is shown as it would be approximately.

The load diagram with and without the battery in service shows the far better load-factor obtainable through the use of a battery. The battery chosen tentatively has capacity, at the one-hour rate, to carry the entire station load during the peak for one hour. The size of battery chosen may or may not be the one best suited to the purpose, depending upon the number of machines and their capacity that would have to be operated at night. The problem is quite straightforward when once all the factors are known, and consists of determining the cost of operation under the various conditions. In the absence of all data only a very general outline of procedure can be given. As querist is apparently not familiar with storage-battery engineering, he might with advantage submit his problem and load curves to some of the large manufacturers of storage batteries, who will offer a solution with guarantee. A guarantee as to performance, life, etc., is particularly advantageous to the purchaser in cases like the present, where many little things may go wrong.—K. R., Chicago, Ill.

New Apartment Houses at Boston Equipped With Electric Ranges.

Two new apartment houses in the Boston Edison Company territory are equipped with electric ranges. One, the Belleden Apartment, on Commonwealth Avenue, Allston District, consists of six and seven-room suites, each of which has its own electric range, electric fireless cookers and vacuum cleaners, besides other modern electric conveniences. Twelve apartments are now ready for renting and 28 more will be built with the same conveniences. The Boston Edison Company, following its regular custom, is advertising these apartments in Boston newspapers.

The other recently constructed apartment house is the Elmdale, in Dorchester, which consists of 31 suites of two, three and four rooms and hall, kitchenette and bath. Each of these apartments is equipped with an electric range.

NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

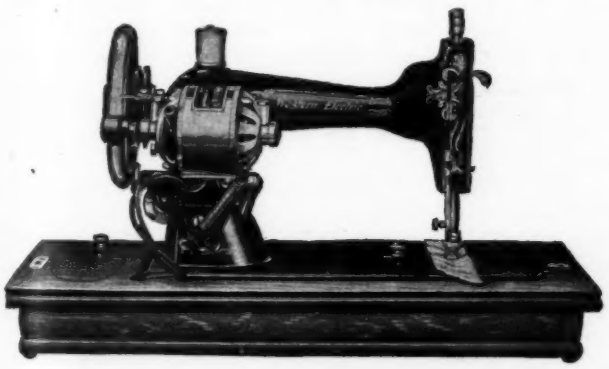
Electric Self-Contained and Easily Portable Sewing Machine.

An ordinary sewing machine has two inherent disadvantages for the housewife. It is true that when Howe invented the sewing machine, it was quite a step forward in taking the slow and tiresome drudgery out of sewing, but the footwork necessary to operate the treadle and produce the necessary power also produce backache and a draggy, tired feeling in the operator.

The second disadvantage is the ordinary sewing machine, no matter how attractively designed and built, is nearly always in the way and it is quite a "moving" job to take it from room to room, and more of a job from floor to floor.

The first objection was overcome by the advent of the sewing-machine motor. This did away with the laborious treadle work, and was a move in the right direction, but the second objection has still been present, and prevented the housewife from realizing the utmost in convenience.

The Western Electric Company, Incorporated, is placing on the market this fall, a portable electric sewing machine, which fully overcomes the second and last objection. The entire equipment—the sewing-machine head and motor—is completely inclosed in a quarter-sawed oak cover. When the machine is not in use, the rheostat and foot control are housed in this same cover. The entire machine, cover and all, occupies only a small amount of space, and when not in use may be placed out of the way in a closet or under a couch.



Compact, Portable, Electric Sewing Machine.

Its portability is another feature which will appeal strongly to the modern housewife. Wherever there is an electric lamp socket, there the machine may be used. It is compact and simple and operates on either direct or alternating current. It may be used in any room, and in the summertime on a card or sewing table on the porch. For sewing sheets or other large materials, it may be conveniently placed on any large table.

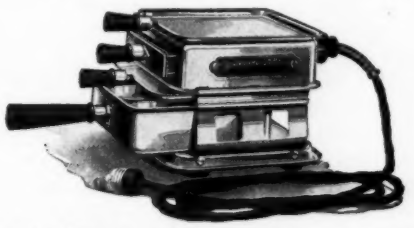
This latest addition to the Western Electric line of household helps will, like all of the others, be backed by an aggressive sales campaign, including window displays and literature for the use of the agents.

The sewing machine proper is high class in every particular, is of the standard rotary type, and possesses all of the easy running and perfect stitching qualities typical of rotary machines. In addition, it has many desirable and exclusive features, including the automatic tension that is self-regulating, automatically adapting itself to all classes of goods.

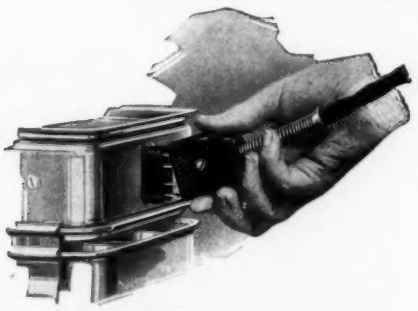
Electric Combination Table Stove for Several Simultaneous Cooking Operations.

The increasing popularity of electric cooking appliances has led the Standard Stamping Company, Marysville, O., to place on the market the Standard table stove, for which it claims several important advantages.

The heating element used in this combination appliance is made in two sections, one above the other, with an inch and a half space between them. In the space between the two sections of the heating element a wire toaster drawer is located so that both sides of the bread are exposed to the heat and are toasted at the same time. This arrangement of the heating element not only permits of the toasting of both sides of the bread at the same time, but also allows two additional cooking operations above and below the two outer surfaces of the heating element. Toasting does not in any way interfere with other cooking operations. For instance, eggs may be fried in one of the griddles on top of the stove, bread toasted in the toaster drawer and bacon or chops broiled in the deep vessel below, all at the same time and at the same expense.



Standard Electric Table Stove Outfit Complete.



Improved Attachment Plug for Table Stove.

An egg-poaching attachment with four egg cups for use in the deep vessel is included in the regular equipment and provides a most delectable means for preparing eggs. The deep vessel is also provided with a removable grid for use when broiling.

The Standard table stove is equipped with a novel attachment plug which operates by a tilting motion instead of a straight push-in or pull-out. This in itself is a selling point of no little value. It is a common complaint that attachment devices on electric heating appliances have been a fruitful source of annoyance both to the user and the distributor. Particularly after a little use, the contact pieces tend to corrode in a manner that makes the operation of the ordinary attachment plug difficult. Naturally, a cooking device of this kind becomes quite hot while in use and when it is necessary to hold the hot stove with one hand while endeavoring to disconnect a plug that sticks, the result is not pleasing to the user.

The manufacturer claims that the Standard table stove will broil, boil, fry, poach, steam, toast and, in short, do anything but bake. It compares favorably in price and in energy consumption with other similar devices now on the market. It takes 575 watts at 110 volts.

Electric appliances and particularly the smaller cooking devices are increasing in use at a truly wonderful rate. With the cost of electric current tending downward while the price of most fuels seems to advance from month to month, it would appear that the time is not far removed when electricity will occupy a dominating place in the household, and our readers will be wise to acquaint themselves with a device which would seem to present features worthy of investigation.

Ohmlite Fixtures for Interior Lighting.

A new line of fixtures, unique in design and incorporating an entirely original principle of construction, has been placed on the market under the trade name Ohmlite fixtures. The most striking feature of these fixtures is their use of a series of filtering planes of diffusing glass surrounding the light source so that no rays strike the eye without first passing through them. The object of these planes is not only to diffuse the bright, direct light of lamps with high intrinsic brilliancy and thereby minimize glare, but also to cut out any injurious infra-red or ultra-volet rays there may be present.

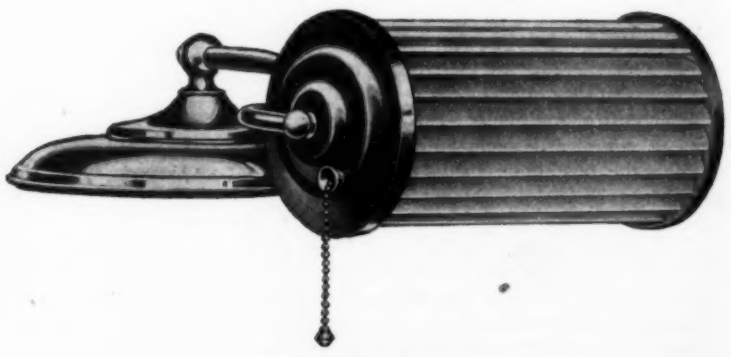
The planes are spaced apart from each other somewhat like the vanes on a turbine, so that they allow exceptionally free ventilation about the light source. Various arrangements of the planes are possible, the accompanying illustration showing three types—conical, cylindrical and a form resembling the lower part of an acorn. These and other arrangements permit a variation of the reflecting character of the fixture, making it possible to throw the light downwardly, laterally or upwardly. The planes are supported between a slotted top ring and a notched lower guide, resting on a felt pad to protect them at the bottom; the pad is covered with a cap and bottom knob. A slightly modified mounting is used for cylindrical pendent and desk fixtures.

Two Forms of Ohmlite Pendent Fixtures of Simple Design.

In appearance the glass part of the fixture presents a novel, soft, glowing effect that is quite pleasing to look at. The metal parts of the fixtures are either quite plain or more or less ornamental to suit requirements. The fixtures are adaptable for the lighting of stores, offices, banks, libraries, schools, etc. They are intended, with the exception of the desk lamp, for use with gas-filled tungsten lamps, thus making a very efficient unit.

Ohmlite fixtures are made by the Moran & Hastings Manufacturing Company, 16 West Washington Street, Chicago, Ill. This company, which in the last 25 years has established an enviable reputation in the fixture business, has added an illuminating engineering department in charge of an experienced engineer. This department is ready to give free expert advice on lighting problems.

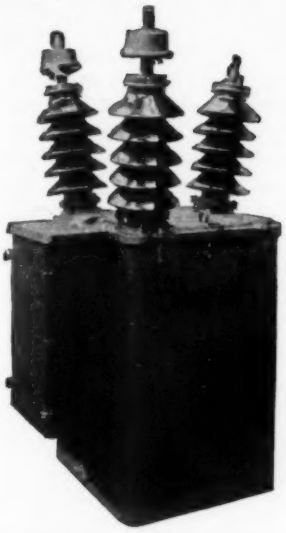
Ohmlite Ceiling Fixture.



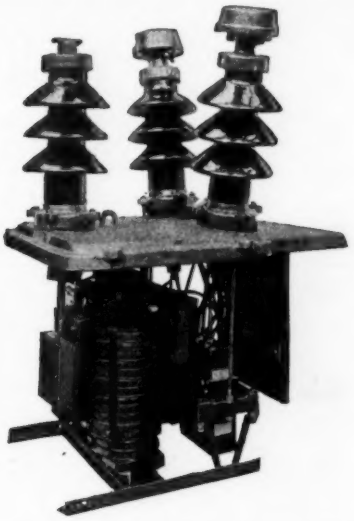
Ohmlite Desk Lamp.

Outdoor Metering Equipments.

The supplying of service from high-tension transmission lines, where the expense of a substation is not warranted, has prompted the Westinghouse Electric & Manufacturing Com-



Outdoor Metering Equipment Inclosed in Case.



Interior of Meter Equipment, Case Being Removed.

pany, East Pittsburgh, Pa., to develop a line of metering equipments inclosed in weatherproof casings, of which the one illustrated is typical. These outdoor metering equipments have been developed so far for 60-cycle, polyphase service, for current ratings to 200 amperes and voltages from 11,000 volts up.

Each equipment consists of a standard polyphase watt-hour meter, two current transformers, a polyphase voltage transformer, and three choke coils, all inclosed in a sheet-steel case with cast-iron cover supporting three high-tension outdoor type terminals. The steel case is subdivided into two compartments, one of which is filled with oil in which the transformers and choke coils are immersed, while the other serves to inclose the meter and meter panel. On the meter panel are also mounted two fuses to protect the voltage circuit of the meter and two calibrating links located in the current circuit of the meter. These calibrating links consist of fuse clips with a brass tube inserted instead of fuses. The meter may be read or checked upon opening the hinged door which covers the entire front of the meter compartment. The arrangement is such that the entire outfit, including meter panel, can be raised out of the tank without disconnecting meter leads.

Three primary outlet terminals provide the necessary primary connections, one of the terminals serving as the common connection of the voltage transformer windings, while each of the other two terminals provide connection for one current transformer and one end of one of the voltage transformer windings.

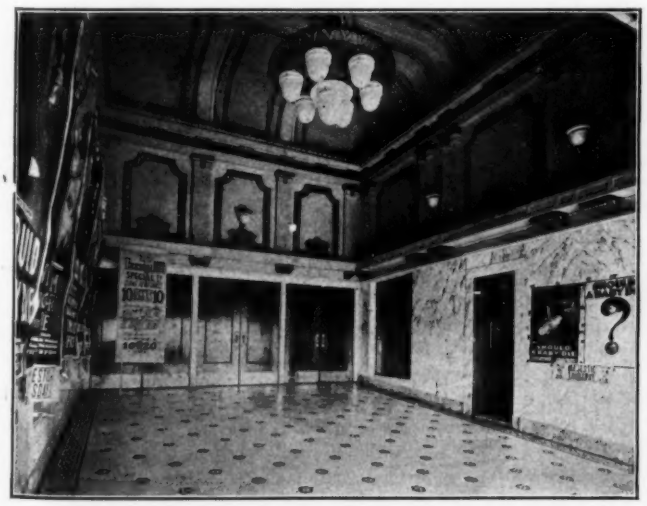
The current transformers each have two primary windings which may be connected in series or in parallel by connecting links in the weatherproof cap at the top of the outlet terminals. The polyphase voltage transformer consists of a three-phase core having windings on the two outer legs only, and is therefore equivalent to two single-phase voltage transformers connected in open delta.

Choke coils are inserted between the voltage transformer windings and the outgoing leads, to protect the transformer.

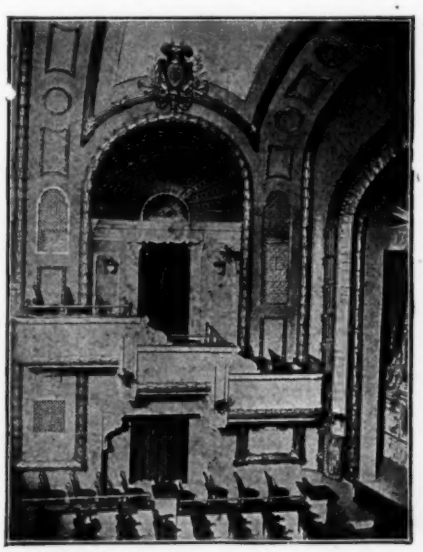
Up-To-Date Electrical Equipment in a New Southern Theater.

The new Majestic Theater, Dallas, Tex., is one of the most beautiful in the Southwest. Equipped with every modern theater appurtenance it affords its patrons Broadway attractions in a Broadway atmosphere. The theater has a seating capacity of 1,500 people and represents an investment of $135,000.

The theater is lighted with Brascolite fixtures and Sunbeam Mazda lamps. Ceiling fans are used in the gallery and in that part of the orchestra directly under the balcony. Sixteen-inch bracket fans are used for the boxes and the orchestra. All this electrical equipment was furnished by the Dallas office of the Western Electric Company.



Foyer of Majestic Theater, Dallas, Showing Lighting Fixtures.



Lighting Fixtures and Fans for Boxes.

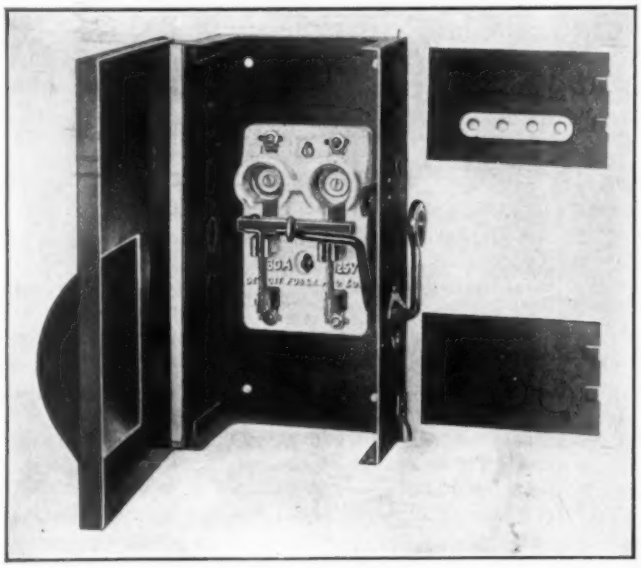
A Line of Inclosed Switches for Safety.

Accounts of accidents resulting from the use of open switches in industrial plants are frequently published. Often such accidents go unrecorded, but were it possible to make an accurate accounting the total would probably be surprisingly great. An open-switch accident may mean death from shock to a workman and the resultant demoralization of others. Or a switch may be thrown while a repair man is working on machines that are shut down. Fires resulting in loss of lives and property are also occasionally caused by short-circuits from open switches.

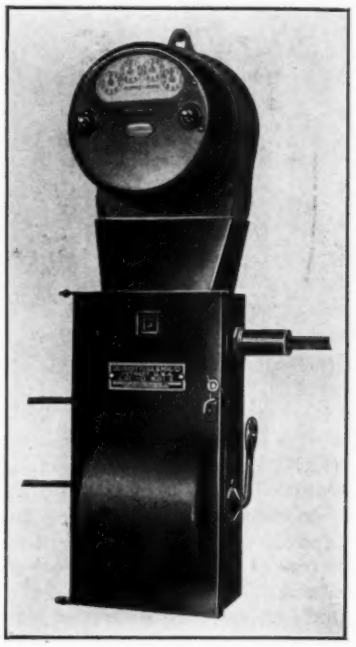
A line of "Square D" inclosed switches, many of which have already been in extensive and successful use, is being advocated as a solution for the open-switch evil. The development of this switch has been carried out in accordance with the principles of the "Safety First" movement, aiming particularly in making safe electrical equipment.

The "Square D" inclosed switch is also recommended for the use of central stations as entrance service equipment where metered service is given. It effectually prevents the theft of current which is often accomplished by wiring around the meter. The switch terminal and fuse are under lock and key, and while the electric current user can turn the current on or off at will by means of the handle outside the box, the current-carrying parts and wiring remain inaccessible. Meter trims for joining the switch box and meter are available for any type of service meter.

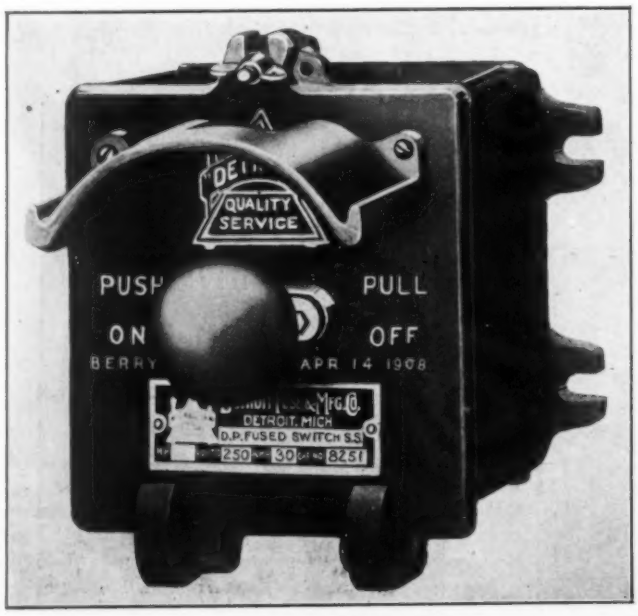
The switch and cutout unit are completely inclosed in a metal box provided with a hinge cover which is held closed with a simple spring catch. The switch is operated by a crank handle located outside the box. The switch may also be locked in the "off" position to prevent accident when repairs are in progress. Means are also provided to lock or seal the cover shut to prevent unauthorized



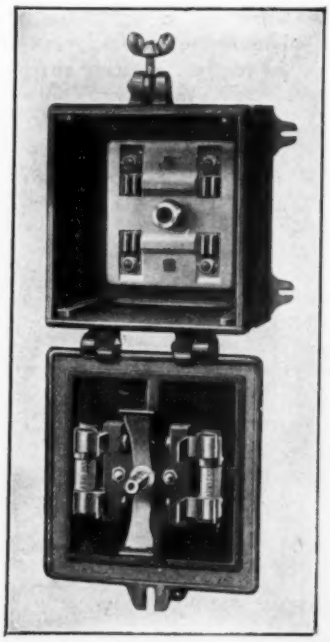
Inclosed Service or Circuit Switch, Showing Changeable End Plates.



Inclosed Service Switch and Meter Connection.



Plunger-Type Switch With Cast-Iron Inclosure.



Plunger-Type Switch Open.

persons overfusing the switch or tampering with live connections. All these switches are provided with labels issued by the Underwriters' Laboratories, indicating that they have been examined and tested as safety apparatus. They have also been definitely approved by the United States Bureau of Standards and the Workmen's Compensation Service Bureau.

This line of inclosed switches is made in two general types: the pressed-steel type suitable for lighting circuits, machine tools and other uses where severe service conditions do not prevail, and the plunger or cast type, which is of more rigid construction and designed for especially severe service.

The pressed-steel switch is made for all commercial voltages from 125 to 600 volts, and in capacities of from 30 to 600 amperes. All switches for 60 amperes and over are equipped with a quick-break attachment to prevent the formation of dangerous arcs. The ends of the pressed-steel box are removable and can be equipped with plates for suitable knockouts to fit any wiring condition. The plunger switch has the switchgear inclosed in a cast-metal casing and, as in the case of the pressed-steel type, the mechanism is operated from the outside of the box. The switch mechanism is of the quick-make-and-break type and when closed a gasket in the lid makes the box fire, water and fumeproof, so that installations may be made where water, fumes and dust exist without injury to the working parts of the switch. These switches are so constructed that the covers cannot be removed when the switch is in the "on" position. Neither can the covers be closed after opening, until the mechanism is brought to the "off" position. This arrangement has been worked out so as to obviate the possibility of short-circuits in dangerous atmosphere in the process of opening and closing the switches.

The "Square D" inclosed switch has its applications wherever safety is considered as a factor in the operation of electrical apparatus. It is worthy of note that liability-insurance companies consider the safety value of this switch in computing premiums for such insurance.

In general the "Square D" inclosed switch meets the requirements for a safe, foolproof, efficient and economical inclosed switch. It is being marketed by the Western Electric Company, Incorporated.

Socket Cap Adapted for Connection of Armored Cord.

The use of armored cord is very desirable for connecting to sockets in places where special hazards exist or where the cord is subject to very severe usage. The use of such cord has been limited because no suitable means for connecting the cord to the sockets has heretofore been available. To meet the growing demand for this type of cord, there has been placed on the market a circuit cap of special construction which admirably provides the desirable connecting means. The use of this improved cap will doubtless serve to enlarge the field of usefulness of armored cord.

Socket Cap for Armored Cord.

This new cap has a threaded ring which swivels around a split composition bushing specially shaped to fit the metal covering of the cord. As the threaded metal ring is screwed into the aluminum top of the socket cap the composition bushings are drawn snugly around the metal casing. This operation positively relieves all strain on the bared conductors attached to the binding screws, thus enhancing the value of this device as a pendent unit.

In the accompanying illustration is shown a porcelain key socket equipped with the special strain-relief cap just described. All users of porcelain sockets for industrial use will find this new combination especially valuable. This device is manufactured by Harvey Hubbell, Incorporated, Bridgeport, Conn.

Westinghouse Direct-Current Automobile Meters.

The two types of meters illustrated have recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. They are designed for use on the automobile dash or cowl when electric generators, motors, and storage batteries are used for starting, lighting and ignition. While especially developed for this service they also find similar applicaton on motor boats, yachts, aerial craft and the like. The meters possess a degree of accuracy adequate for the service for which they are intended, being greatest at the most important operating points on the scale. They are mounted in open-faced, circular, pressed-metal cases arranged with a flange for flush mounting and provided with terminal studs for rear connection. These meters are self-contained, no external shunts or resistors being required. Two standard finishes are provided, full polished nickel and black rubberoid. The dials are of metal and are furnished in two finishes, white nickel with black figures and pointers, and black with white figures and pointer.

The type EW meter is made as a voltmeter or an ammeter and is for use on large cars where a three-inch dial is desired. The ammeter scale ranges from 15-0-15 to 30-0-30; the voltmeter scale from 3.5-8.5 to 7-17 volts. It operates on the D'Arsonval principle, involving a permanent magnet and a moving coil with spiral current-carrying springs mounted in pivot and jewel bearings, the movement being rendered dead beat by winding the moving coil on an aluminum damping frame.

The type EI meter has a two-inch dial and is made as an ammeter only, with scale ranging from 15-0-15 to 30-0-30. It is of the polarized-vane type, in which a moving soft-iron vane is polarized by a stationary permanent magnet and deflected over the entire scale by the action of a stationary current coil. No springs or moving coil are used, thus resulting in great simplicity and ruggedness. The indications are made dead beat by means of an air damper.

Depending upon the characteristics of the charging generator system, a voltmeter or an ammeter or both are used. The voltmeter is usually connected across the storage battery, if a lead-plate battery, to indicate its condition of charge. The ammeter is generally connected in series with the storage battery to indicate whether the battery is charging or discharging, and the amount of current flowing, thereby providing a check on the operating condition of the charging generator system.

Moving-Coil Type Ammeter for Automobile Use.

Moving-Vane Type Ammeter for Automobiles.

INDUSTRY ACTIVITIES

The A. A. Electric Manufacturing Company announces the removal of its office and factory to 303 Center Street, Bridgeport, Conn.

Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, Ill., has issued a folder descriptive of its "Denzar" lighting fixtures.

Templeton, Kenly & Company, Chicago, Ill., have issued Bulletin 216, on "Simplex Jacks." The use of these jacks in pulling telephone poles and for industrial purposes is shown.

Schweitzer & Conrad, Berteau and Ravenswood Avenues, Chicago, Ill., have issued Bulletin No. 1A, on extra-high-potential fuses. Results of tests and illustrations of fuses and fuse mountings are included in the bulletin.

Hughes Electric Heating Company, 211 West Schiller Street, Chicago, Ill., has issued a catalog on electric bake ovens, illustrations and specifications being given for each type. A phantom view of one of the types is of unusual interest.

Central Electric Company, 320 South Fifth Avenue, Chicago, Ill., has issued the fall lighting number of *Electron,* its house organ, which contains articles on the "Dalite" system for railway-car lighting, the need for better industrial lighting, artificial office lighting and other lighting subjects.

Landers, Frary & Clark, New Britain, Conn., have issued a mailing folder which gives illustrations and prices of its line of electric coffee percolators. Announcement is made of a window display contest to be conducted this month. Cash prizes will be awarded to dealers having the best window display in which the "Universal Percolator Girl," a dealer help, takes part, the awards to be made on originality, general attractiveness and trade-winning features.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa, is furnishing two new electric locomotives to the Boston & Maine Railroad for use in the Hoosac tunnel, the longest electrified tunnel in America. The new locomotives will correspond with the five already in use. Each is a 130-ton, 11,000-volt, single-phase unit equipped and has four 375-horsepower series commutating motors with compensated auxiliary field windings. Electric service through the tunnel has been very satisfactory. Rapid growth of traffic requires these additional locomotives.

Western Electric Company has instituted a selling campaign on its Junior electric range. Last year the company introduced the range and through a broad and thorough selling campaign Junior ranges found their way into thousands of homes. This year another campaign will be made of even greater magnitude. The range proved so good last year it has not been changed in design, equipment or price, and the campaign back of it augurs well for a repetition of last year's success. Space is being used in the trade papers now to serve notice to the trade that once again the Junior range is in their midst. The general publicity campaign includes a half page in the *Saturday Evening Post* and two full pages in *St. Nicholas.* A special window display featuring a cut-out will be supplied to dealers. The cut-out is a multicolored affair depiciting two little girls playing with the little range. The range itself fits into the cut-out and makes a most realistic and effective piece of advertising. An attractive stuffer, printed in eight colors, will be supplied to dealers for direct distribution by them. The company is fully prepared to help dealers sell these ranges, and they will find no difficulty in disposing of an article with the universal appeal and the publicity that is back of the Junior range. To all indications the 1916 campaign will eclipse that of 1915.

Atlas Selling Agency, Incorporated, 450 Fourth Avenue, New York City, has issued a folder as its first announcement regarding the "Six-in-One" fuse plug. This plug, which combines six fuses in one, has large merchandising possibilities, and extensive sales plans, including a national advertising campaign, are being made for the introduction of the device. The folder gives a reproduction of a display card being furnished to dealers and suggestions for window displays.

The Electric Storage Battery Company and the **Exide Battery Depots, Inc.,** of Philadelphia, Pa., have moved into their new building at Baker and West Peachtree Streets, Atlanta, Ga. The new building is two stories and has an area of 22,880 square feet. On Peachtree Street is an entrance to a room 40 by 60 feet which will be used for giving battery service to owners of gas and electric cars. Back of the service station, on the second floor, is the main battery room, about 60 feet square. On Baker Street is another entrance which opens directly into the receiving and shipping room, which is 60 by 40 feet. The sales office of The Electric Storage Battery Company and the office of the Exide Battery Depots, Inc., are located on the second floor, the remaining space being used as a shop and stockroom.

Exhibitors at New England Contractors' Convention.—At the convention of New England electrical contractors held at Hartford, Conn., last week exhibits were made by the Hartford Electric Light Company, Hartford, Conn.; V. V. Fittings Company, Philadelphia; Consolidated Lamp & Glass Company, Boston; Falkenbach Manufacturing Company, Boston; Electric Supply & Equipment Company, Hartford; Sa-Jo Mirror Company, Hartford; C. I. Brink, Incorporated, Boston; Hygrade Lamp Company, Salem, Mass.; Manhattan Electrical Supply Company, New York; A. L. Bergmann, Hartford; Telegraphone, H. P. O'Reilly Company, Springfield, Mass.; Metropolitan Electric Manufacturing Company, Long Island City, N. Y.; Thomas & Betts Company, New York; Hoover Suction Sweeper Company, New Berlin, O.; Holtzer-Cabot Electric Company, Boston; Standard Electric Time Company, Springfield, Mass.; American Model & Instrument Company, Worcester, Mass.; E. R. Bryant, Boston; Fire Alarm Signal Company, Boston; Pass & Seymour, Incorporated, Solvay, N. Y.; Holophone Glass Company, New York; Samson Electric Company, Canton, Mass.; Spencer Turbine Cleaner Company, Hartford; Edward Miller & Company, Meriden, Conn.; Luminous Unit Company, St. Louis; Eureka Vacuum Cleaner Company, Worcester; Lebanon Machine Company, Lebanon, N. H.; G. O. Simmons, Hartford; Hessel & Hoppen Company, New Haven; Wetmore-Savage Company, Boston; Landers, Frary & Clark, New Britain; Johns-Pratt Company, Hartford; Hart & Hegeman Manufacturing Company, Hartford; Pettingell-Andrews Company, Boston; Electric Cable Company, Bridgeport; Hart Manufacturing Company, Hartford; Robbins & Myers Company, Springfield, O.; Bryant Electric Company, Bridgeport; Stuart-Howland Company, Boston; Rubes Electric Devices, Incorporated, Brooklyn; Albert Mann, Boston; Arrow Electric Company, Hartford; Harvey Hubbell, Incorporated, Bridgeport; Trumbull Electric Manufacturing Company, Plainville, Conn.; Grant Vacuum Cleaner Company, Providence, R. I.; Robert R. Ashwell, Hartford; Franklin Electric Manufacturing Company, Hartford; Flexlume Sign Company, Buffalo, and Benjamin Electric Manufacturing Company, Chicago.

PERSONAL AND BIOGRAPHICAL

MR. R. E. BURGER, who has been manager of the light, heat and power department of the Toledo (O.) Railways & Light Company, has become manager of the properties of H. L. Doherty & Company in Ashland, O., and Mansfield, O. The latter company has a large power plant in course of construction at Mansfield.

MR. H. C. HOAGLAND, formerly general manager of the Fort Smith (Ark.) Light & Traction Company, has been transferred to Muskogee, Okla., and will assume charge of the H. M. Byllesby & Company's plants in that city and Oklahoma City and El Reno. He was transferred from Muskogee to the Fort Smith company three years ago.

MR. D. F. McGEE, of the Electric Bond & Share Comany, with headquarters in New York City, is on a tour of inspection of the Utah Power & Light Company's properties. He recently visited the system of the Western Colorado Company and will go from Salt Lake City to the Northwest, where his company has extensive interests.

MR. GEORGE R. VEEDER has been appointed manager of retail sales for the Woods dual power automobile, manufactured by the Woods Motor Vehicle Company, Chicago, Ill. Mr. Veeder is well known in the electric vehicle field, having been for three years Chicago sales manager for the Anderson Electric Car Company, manufacturers of the Detroit Electric.

MR. ALFRED F. TOWNSEND, for seven years manager of the Woonsocket division of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., has assumed the management of the Eastern Texas Electric Company, a Stone & Webster company. He will make his home in Beaumont, Tex., and will have charge of lighting, power and traction companies in that section.

MR. WILLIAM H. RICHARDSON, for eight years cashier of the Brattleboro (Vt.) division of the Twin State Gas & Electric Company, Dover, N. H., has been appointed to succeed MR. E. M. ADDIS, who has recently resigned, effective October 15. The former has been a lifelong resident of Brattleboro. After taking the high school course he attended a business college and for five years was in the office of a local manufacturer.

MR. J. E. FRIES, has recently been appointed chief electrical engineer for the Tennessee Coal, Iron & Railroad Company, with headquarters in Birmingham, Ala. Mr. Fries is a native of Sweden and was graduated from the University of Stockholm, after which he came to the United States. For eight years prior to his acceptance of the position with the Tennessee company he was assistant engineer for the Crocker-Wheeler Company, Ampere, N. J. Mr. Fries is a Fellow of the American Institute of Electrical Engineers and a member of other engineering organizations.

MR. FRANK H. GALE, of the General Electric Company, was called to Jacksonville, Fla., early this week by the serious illness of his mother.

MR. D. W. ROPER, superintendent of the street department of the Commonwealth Edison Company, Chicago, Ill., has been appointed first vice-president of the Western Society of Engineers, to succeed MR. C. H. CARTLIDGE, deceased.

MR. W. W. FREEMAN, president of the Union Gas & Electric Company, Cincinnati, O., and chairman of the Public Policy Committee of the National Electric Light Association, was one of the principal speakers at the convention of the Investment Bankers' Association of America, held in Cincinnati this week. Mr. Freeman stated that an era in which the public will have confidence in the public utility is at hand. "The public," he said, "has had a misconception of facts generally as applied to public utilities and the application of the public's own methods of regulation has turned the tide against the public. This application of these popular theories has served to tell the public facts which the utilities could not have told in any other way."

W. W. Freeman.

MR. W. M. TOMPKINS has been appointed representative of the Ward Leonard Electric Company, of Mount Vernon, N. Y., in Philadelphia, Pa. Mr. Tompkins' broad experience in the electrical field and his knowledge of motor controlling devices places him in a very advantageous position for serving the trade and his company in Philadelphia.

MR. PAUL H. STAMBAUGH, for several years power sales engineer for the Mahoning & Shenango Railway & Light Company, Youngstown, O., resigned several weeks ago and is now in the engineering and sales engineering department of the Petroleum Iron Works Company, Sharon, Pa. He attended the recent convention of Iron and Steel Electrical Engineers in Chicago, and took an active part in the proceedings.

MR. W. D. SCHNAUDER, superintendent of power for the Texas Power & Light Company, gave a demonstration of the use of a high-frequency oscillator in testing high-voltage insulators at a meeting of the Dallas Electric Club and Jovian League September 29. The oscillator used was designed for tests on potentials up to 100,000 volts.

MR. MAURICE E. BATES, former city electrician of Kansas City, Mo., who resigned when the new administration took charge a few months ago, recently took the civil service examination arranged for the selection of a city electrician and received a grade considerably in excess of that received by the temporary incumbent. He will resume the position soon. Electrical engineers conducted the examination for the Civil Service Board.

MR. JOHN L. FAY, of St. Louis, Mo., has become associated with the Paducah (Ky.) Pole & Timber Company and the Southern Pine Manufacturing Company as sales manager. Mr. Fay was superintendent of electrical construction for the Union Electric Light & Power Company, St. Louis, and was president of the Company Section, National Electric Light Association. He is a member of the American Institute of Electrical Engineers, the St. Louis Jovian League of Electrical Interests, the Engineers' Club of St. Louis, a member of the committee on rules and regulations governing construction and maintenance of poles, wires, cables, etc., for the Missouri Association of Public Utilities, and a member of the present committee on overhead lines and inductive interference of the National Electric Light Association.

OBITUARY.

MR. H. F. CHADWICK, former secretary of the standards committee of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., died September 25 after nearly a year's absence from work on account of ill health. Mr. Chadwick was a native of Marion, Mass., and graduated from Tufts College in 1900. Upon graduation he was instructor in the electrical department of the college for a year, after which he became associated with the Lorain Steel Company, Johnstown, Pa., where he remained for a similar period. Subsequently he became connected with the Westinghouse company at East Pittsburgh as a mechanical engineer. After some time devoted to mechanical engineering Mr. Chadwick was made assistant chief draftsman, which position he held for four years, having charge of premium work in connection with this department. At the time of the organization of the standards committee, Mr. Chadwick was made secretary, which position he continued to hold while with the company. The deceased had for a long time been particularly active in the work of standards and his knowledge and experience along these lines was of great value to the company.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

SKOWHEGAN, ME.—A revival of the proposed Skowhegan-Athens electric railway project has been made. Only about $8,000 is lacking in pledges to complete the $100,000 necessary before construction can be started.

METHUEN, MASS.—The Selectmen have granted permission to the Lawrence Gas Company to erect poles on Broadway and Oak Street.

NEWBURYPORT, MASS.—A hearing was held September 21 before the Massachusetts Waterways and Public Lands Commission at Boston on a petition of the Newburyport Gas & Electric Company for permission to lay a cable from its new station across the Merrimack River to Ring's Island, in Salisbury, for the purpose of supplying electricity to the Amesbury Electric Company. There was no opposition.

NORTH ADAMS, MASS.—The New England Power Company, of Shelburne Falls, is planning the erection of a transmission line from its power plants on Deerfield River to supply electrical energy to the Beaver Mills.

PALMER, MASS.—The Power Construction Company has begun the construction of a high-tension line to Ware.

WORCESTER, MASS.—Delay in the receipt of gas pipe by the gas company is resulting in holding back the laying of pipe to householders in the newer parts of the city, and stimulating the use of electricity for heating, as well as for lighting. Many complaints at the delay are voiced.

NEW BRITAIN, CONN.—The North & Judd Manufacturing Company will erect a new power station, 57 by 87 feet, at a cost of about $30,000. New generating apparatus will be installed.

NEW HAVEN, CONN.—The Connecticut Company, operating trolley lines throughout this state, has been granted a building permit to erect an addition to its power house in Grand Avenue, to cost about $118,000. Complete with equipment for producing power, the new plant, it is estimated, will cost about $250,000. The structure will be 78 by 148 feet, two stories, and of fireproof construction.

AUBURN, N. Y.—City officials and representatives of the Empire Gas & Electric Company are conferring on the question of a new contract for lighting public buildings and the outer district. The specifications in connection with the new contract for lighting provide for bids on three types of lighting units, to be used in the outlying districts.

ALBANY, N. Y.—The City Council has passed an ordinance authorizing the installation of ornamental lamps in Lakewood Boulevard.

BROOKLYN, N. Y.—Mayor Mitchel has announced his approval of the project by which the city will engage in the distribution of electrical energy for municipal purposes in the Thirtieth Ward. Plans submitted by William Williams, Commissioner of Water Supply, Gas and Electricity, call for the purchase of energy from the Brooklyn Edison Company and its distribution from a central point. The plans also propose the replacement of 5,234 gas lamps with 2,700 electric-lighting units.

BUFFALO, N. Y.—Approval of a five-year contract with the Buffalo General Electric Company, including the installation of 2,500 Mazda type C units, has been made by the City Council. A two-year contract was also approved for furnishing energy for the city's arc-lamp system.

ELLICOTTVILLE, N. Y.—The Ellicottville Electric Light Company has been awarded a new five-year contract to supply energy for the street-lighting system.

PERRY, N. Y.—Construction of the transmission lines of the Perry Electric Light Company between this city and Silver Springs, Rock Glenn and Warsaw is nearly completed. Work has not been started on the new power house here, as the shipment of equipment has been delayed at the factories.

PORT JEFFERSON, N. Y.—The Port Jefferson Electric Light Company has sold its holdings to the North Shore Electric Light & Power Company for a consideration of $60,000.

BELLEVILLE, N. J.—The Kent Motors Company, New York City, will build a power plant in connection with its new manufacturing plant on Washington Street. F. H. Clarke is president.

IRVINGTON, N. J.—The Town Commission has adopted a resolution providing for the installation of new 600-candlepower, nitrogen-filled street lamps.

RIDGEWOOD, N. J.—The Board of Education will receive bids for electrical work in the new high school building up to 8 p. m., October 30. H. S. Willard is president of the board.

CROMBY, PA.—The Philadelphia Suburban Gas & Electric Company his broken ground for a new power plant to cost about $500,000. The plant will be used for service for Pottstown, Phoenixville and West Chester.

DARBY, PA.—The Delaware County Electric Company has been granted permission to operate a local street-lighting system, under contract with the city.

LOCK HAVEN, PA.—The Eagle Electric Light Company, the Fleming Electric Company and the Mill Hall Electric Light Company have been incorporated, with a capital of $5,000 each, by W. F. Harris, of this city, and others.

PHILADELPHIA, PA.—The Electrical Bureau has prepared plans for a new power plant in the city hall, to cost about $90,000, for municipal service. The installation will comprise two 650-horsepower engines, one 325-horsepower engine, generators, and six triplex electrical pumps. James F. McLaughlin is chief of the bureau.

READING, PA.—The Boyerstown Electric Company will close its generating station and purchase electric energy from the Metropolitan Electric Company. The Boyerstown plant will be used for emergency purposes.

TAMAQUA, PA.—The Public Service Commission has approved a street-lighting contract for local service by the Eastern Pennsylvania Light, Heat & Power Company.

UNION CITY, PA.—The Public Service Commission has approved a contract for the operation of a local street-lighting system by the Union City Electric Company.

WASHINGTON, D. C.—The report of the special board of engineer officers, recommending the establishment of a power plant near the Great Falls of the Potomac, has been made to Secretary of War Baker. The board substantially indorsed the report of the Langfitt board, which made an extended investigation of the proposition. The plant contemplates the construction of a dam about a third of a mile above the Chain bridge, and the District water supply would be increased by pumping to the Dalecarlia reservoir from the lake formed by the dam. The estimated cost of the project was $5,172,000 for the water pumping and $9,849,000 for the power developments.

RICHMOND, VA.—The James River & Kanawha Power Company has purchased a site near this city for the purpose of erecting an electric power plant. W. P. De Saussun is manager of the company.

ROANOKE, VA.—The Norfolk & Western Railway will spend between $2,000,000 and $3,000,000 on extensive improvements at various points in its system. Among the improvements planned is the extension of the electrification system in three of its divisions.

LOGAN, W. VA.—The Boone Power Company has been incorporated with a capital of $5,000 by M. A. Maxwell, A. M. McCormick and others, of this city. The purpose of the company is to supply energy for lighting and industrial purposes in Logan County.

BELHAVEN, N. C.—A proposition to issue $60,000 in bonds for the construction of an electric-lighting plant and waterworks and sewer systems will be considered by voters here at an early election.

HICKORY, N. C.—The city has granted a franchise to the Southern Public Utilities Company, of Charlotte, N. C., to construct and furnish energy for a white-way system here.

LAWNDALE, N. C.—The Lawndale Power Company has been incorporated with a capital of $100,000, and will build an electric power plant.

CENTRAL, S. C.—The city has voted $10,000 in bonds for the construction of an electric-lighting system.

VERO, FLA.—N. J. Norman, of St. George, Ga., will establish an electric-lighting and ice plant here.

NORTH CENTRAL STATES.

SEBRING, O.—The Ohio Electric & Gas Company has presented a proposition to the city under the terms of which it plans to purchase the old McKee lighting plant, increase it in size and install larger equipment and give electric service here.

TIFFIN, O.—The Ohio Light & Power Company, with central district headquarters in Tiffin has secured the entire right of way for the high-tension transmission line that will be built this fall between Fostoria and Fremont, through the northwestern part of Seneca County. The line will be on steel towers, and will supply energy to consumers in Amsden, Kansas Station, Bettsville and Burgoon. There will be a branch line to Helena, Gibsonburg and Millersville.

ARENZVILLE, ILL.—The Arenzville Light & Power Company has been incorporated, with a capital of $10,000, to construct and operate a lighting plant here. John G. Pratt is interested in the company.

FAIRBURY, ILL.—The electric-lighting plant owned by the Central Illinois Utilities Company was destroyed by fire recently.

FREEPORT, ILL.—The Illinois Northern Utilities Company has been awarded a new street-lighting contract here. The contract provides for the installation of 275 incandescent lamps of 400 candlepower each. The lamps are to be suspended by an overhead system, except in the business district, where they are to be attached to brackets on the trolley poles. The contract is effective for 10 years from January 1.

HEBRON, ILL.—The L. E. Myers Company is making an extension of its transmission lines to this city, and will furnish electric service here.

MUNCIE, ILL.—Plans are being considered here for the installation of the street-lighting system. Energy probably will be secured from the municipal plant at Fithian.

DETROIT, MICH.—An appropriation of $1,000,000 for two new exchanges, additions to present buildings and cable extensions, have been approved by the board of directors of the Michigan State Telephone Company, of which G. M. Welch is general manager.

MANISTIQUE, MICH.—Negotiations have been completed for the transfer of the holdings of the Manistique Light & Power Company and the waterpower rights of the Consolidated Lumber Company to Minneapolis capitalists, represented by Francis W. Little. The new owners have announced plans involving construction work that will cost approximately $1,500,000. The power plant will be enlarged and a new concrete dam will be installed in connection with the construction of a new pulp mill.

PORT HURON, MICH.—The Detroit Edison Company has petitioned the City Commission for a franchise to enter the city with its transmission lines, and proposes

to erect a substation on Military Street to cost $75,000. This proposition is separate from the power-house which the Detroit Edison Company proposes to build at Bunce Creek.

ASHLAND, WIS.—The Chicago & Northwestern Railroad will erect a third ore dock of 5,000 tons capacity here, to cost about $2,000,000, which includes a power plant.

BURLINGTON, WIS.—The Wisconsin Gas & Electric Company is planning to extend its transmission lines to the south shore of Brown's Lake, where energy will be used for private consumption and for the operation of ice harvesting machinery.

HORTONVILLE, WIS.—A franchise has been granted to the Hortonville Heat, Light & Power Company to erect and maintain pole lines here, and to furnish energy for light, heat and power to private consumers. The city has contracted for the installation of 25 street lamps.

RANDOM LAKE, WIS.—The Random Lake Electric Company has been incorporated by T. M. Bowler, C. H. Shaw and H. Kaems, of Sheboygan, to furnish electric service here.

ORFORDVILLE, WIS.—The Orfordville Light & Power Company contemplates the installation of a 120-horsepower oil-burning Diesel engine.

BETHEL, MINN.—The Eastern Minnesota Power Company, of Pine City, will extend its transmission lines from Isanti to this city, and will supply energy for light and power. R. P. Allen is manager of the company.

CEDAR RAPIDS, IOWA.—The Iowa Electric Company has petitioned the Railroad Commission for franchises for the erection of transmission lines in Delaware and adjacent counties.

ELKADER, IOWA.—Schmidt Brothers & Company are planning the extension of their transmission lines from this city to St. Olaf and Farmersburg.

HUMBOLDT, IOWA.—The Northern Iowa Gas & Electric Company has been granted permission to construct a transmission line in Wright County.

SPENCER, IOWA.—The City Council is planning to make improvements to the local electric-lighting system.

MARSHALL, MO.—Henrici, Kent & Lowry, engineers, Kansas City, Mo., have the contract for the erection of a municipal lighting plant, for which bonds in the sum of $75,000 have been voted.

ST. JOSEPH, MO.—The St. Joseph Street Railway Company, J. H. Van Burt, general manager, is planning extensive improvements to its system.

RESERVE, KANS.—A special election has been called to vote on the question of issuing $7,000 in bonds for the construction of a transmission line from Hiawatha to supply this city with electric service.

STERLING, NEB.—Preliminary work and surveys have been completed by the Sterling Light & Power Company for the erection of 50 miles of three-phase, 13,200-volt transmission line. W. W. Marks is general manager of the company.

YANKTON, S. D.—The City Commissioners are contemplating the installation of a white-way system on Douglas Avenue.

FARGO, N. D.—The white-way system on Second Avenue has been completed, and the lights were turned on for the first time September 22. The system consists of 32 single light ornamental standards, equipped with 80-candlepower Mazda lamps. A second installation of similar construction, consisting of 70 posts, is nearing completion, and provision has been made by the City Commissioners for ornamental post lighting on other streets in the residential district.

GRAND FORKS, N. D.—Improvements will be made to the street-lighting system. W. E. Skinner, 415 Plymouth Building, Minneapolis, Minn., consulting engineer, is preparing plans.

MEDINA, N. D.—E. P. Olson and others are planning to install an electric-lighting plant here.

NAPOLEON, N. D.—An appropriation of $5,000 has been secured for the installation of a municipal electric-lighting system.

SOUTH CENTRAL STATES.

ARLINGTON, KY.—A. U. Given is chairman of a committee which is working out plans for providing the city with electric-lighting and water plants.

LANCASTER, KY.—Bastin Brothers have purchased the electric-lighting franchise for the city, and propose to erect a new plant and supply 24-hour service.

DATES AHEAD.

American Electric Railway Association. Annual convention, Atlantic City, N. J., October 9-13. Secretary, E. B. Burritt, 8 West Fortieth Street, New York City.

Electrical Supply Jobbers' Association. Quarterly meeting, Hotel Statler, Cleveland, O., October 10-12. Secretary, Franklin, Overbagh, 411 South Clinton Street, Chicago, Ill.

New Mexico Electrical Association. Executive meeting, El Paso del Norte Hotel, El Paso, Tex., October 15-17. Secretary pro tem, E. A. Thiele, 112 West Third Street, Roswell, N. M.

New England Section, N. E. L. A. Annual convention, Pittsfield, Mass., October 17-20. Secretary, O. A. Bursiel, 149 Trenton Street, Boston, Mass.

Jovian Order. Annual convention, Indianapolis, Ind., October 18-20. Secretary, Ell C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Telephone Pioneers of America. Annual meeting, Atlanta, Ga., October 27-28. Secretary, R. H. Starrett, 195 Broadway, New York City.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Columbus, O., November 16. Secretary, F. E. Sanborn, Ohio State University, Columbus, O.

PAINTSVILLE, KY.—Citizens are taking steps to provide the city with electric-lighting and water plants. John Buckingham is interested in the plans.

PERRYVILLE, KY.—Russell Brothers propose to erect and equip an electric-lighting plant here.

RUSSELLVILLE, KY.—The Russellville Home Telephone & Telegraph Company, with $25,000 capital, has been incorporated by I. E. Knisely and others.

BEARDEN, TENN.—The Colonial Lumber Company is asking for prices on an electric-lighting plant for supplying a small town, new or second-hand equipment being acceptable. J. D. Wyrick is manager of the company.

KNOXVILLE, TENN.—The Vine Street Business Men's Club will push a proposed white-way installation in that business section. Free service has been provided for in the contract which the Knoxville Railway & Light Company recently made with the city.

BESSEMER, ALA.—The Alabama Power Company has commenced the construction of a transmission line from Bessemer to Jasper.

LAFAYETTE, LA.—The City Council has made an appropriation of $20,000 for the installation of an oil engine and generating equipment at the city waterworks plant.

ARDMORE, OKLA.—City officials have decided on plans for a proposed white-way system, and the proposition will be submitted to the voters at an early election. The plans call for the granting of a 25-year franchise to furnish electrical energy for the system.

MIAMI, OKLA.—F. M. Overlees, D. B. Mason and M. H. Overlees, Bartlesville capitalists, accompanied by W. K. Palmer, of the Palmer Engineering Company, of Kansas City, were in Miami recently looking over the country prospective to putting in an electric railway from Bartlesville to Miami.

WAYNE, OKLA.—The City Council is contemplating the construction of an electric-lighting plant.

ATLANTA, TEX.—The Atlanta Electric & Ice Company will rebuild its electric light and power plant which was recently destroyed by fire. The new plant will cost about $40,000.

AUSTIN, TEX.—The City Commission has received bids on a 2,000-kilowatt generator and turbine, complete, with all condensing equipment, to be installed in the municipal electric light and power plant. The proposed improvements will cost about $40,000.

BURNET, TEX.—Plans are being made for the installation of an electric-lighting plant here. W. C. Galloway is interested.

EL PASO, TEX.—The El Paso Electric Railway Company has petitioned the City Council for authority to place its wires underground in the downtown district.

JACKSONVILLE, TEX.—The Jacksonville Electric and Ice Company has been incorporated with a capital of $90,000, to manufacture electricity for light and power and to operate an ice plant.

SAN ANTONIO, TEX.—It is announced by Vories P. Brown, of San Antonio, president of the San Antonio & Austin Interurban Railway Company, that the financing of the proposed road is now practically accomplished, and that the construction work will be started soon. It is planned to build a line from San Antonio to Austin, 82 miles, and a branch line from Austin to Lockhart, 30 miles.

SAN ANTONIO, TEX.—A. E. Fitkin, president of the New York banking firm of A. E. Fitkin & Company, is making a tour of Texas in the interest of what he declares a $25,000,000 electric light and power corporation. He is accompanied by George S Haley, formerly general manager of the Texas Power & Light Company, of Dallas, and who will be president of the new corporation, which is to be incorporated as the Commonwealth Power Company. According to Mr. Fitkin, the corporation plans to purchase a number of light and power plants in the smaller cities of Texas and operate them. Options have been secured on a number of these plants, and the organization will be completed within the next few weeks.

SAN ANGELO, TEX.—The City Commission has refused to grant the application of J. E. Willis, of Abilene, Tex., for a franchise for constructing and operating an electric street railway system here. Negotiations are pending for granting a franchise of this character to the Interstate Electric Corporation of New York.

UVALDE, TEX.—The Uvalde & Leona Valley Interurban Railway Company has been placed in the hands of a receiver, upon application of J. C. Kerbey, of Austin. D. H. Jones, of Uvalde, was appointed receiver.

WESTERN STATES.

PUEBLO, COLO.—A transmission line is being constructed from Devine, Colo., to Wilson, Colo., a distance of 11 miles, by the Arkansas Valley Railway, Light & Power Company, to serve a new alfalfa meal mill being constructed at Wilson. The machinery will be operated by a 150-horsepower motor. While the transmission line is primarily for supplying power to the mill, it will also supply a number of farmers en route and the citizens of the town of Wilson with electricity for lighting and power purposes.

PHOENIX, ARIZ.—Complying with the request of those interested in the South Side Gas & Electric Company, the City Council has postponed action for 30 days on calling a bond election for the construction of a new electric-lighting plant or the purchase of the present one. The electric company hopes to be able to make a definite proposition to the city within the next 30 days.

TEMPE, ARIZ.—The City Council has under consideration the construction of an electric-lighting plant, at an estimated cost of $26,000.

LOGAN, UTAH,—The city has advertised for bids for electric-light bonds in the sum of $15,000.

SALT LAKE CITY, UTAH.—The 90-mile extension of the Utah Power & Light Company's transmission system to the coal fields in Carbon County, Utah, has been completed, and service on the line was inaugurated September 28. The company is now serving the coal properties of the Carbon County Fuel Company and the United States Fuel Company. Other coal operators in this section will be ready to use service in the near future.

RENO, NEV.—The Nicklas Mining Company has announced plans for the development of the Goodwin-Plumas mine in Galena Canyon, embracing the construction of a power generating plant at Battle Mountain. All the mine and mill machinery will be electrified.

POCATELLO, IDAHO.—The Electrical Machinery & Engineering Company has been incorporated with a capital stock of $25,000 by Herman R. Bucks, Frank E. Sanders and Charles M. Staymer. The company proposes to construct and install electrical appliances of all kinds and to act as electrical and mechanical engineers.

CHEWELAH, WASH.—The City Council has decided to make extensive improvements in the street-lighting system.

CLE ELUM, WASH.—Bonds in the sum of $5,000 have been voted by the town of South Cle Elum for the installation of an electric-lighting system.

PORT ANGELES, WASH.—The City Council has ordered extensions of the lighting service for street and residence purposes on Lincoln Street.

SPOKANE, WASH.—The officials of the Idaho Power & Concentrating Company have decided to make the installation of the first unit in its proposed power plant development. The cost is estimated at $15,000.

BANDON, ORE.—Negotiations are under way by the Oregon Power Company for the extension of a transmission line from Coquille to Bandon, a distance of about 28 miles, for furnishing electricity for this city and intervening points, including the coal mines at Riverton, and the towns of Riverton, Lampa, Parkersburg and Prospect.

BEND, ORE.—The Pacific States Telephone & Telegraph Company is planning extensions to its present system in Bend and vicinity that will cost about $12,600, according to J. A. Halliday district commercial superintendent, of Portland.

PORTLAND, ORE.—It is reported that an item of $15,000 is to be included in the 1917 budget for the installation of a lighting system in Mount Tabor Park. Philip Dater is city engineer.

SALEM, ORE.—The city of Myrtle Creek has been granted a permit by the State Engineer to appropriate 150 second-feet of the waters of the South Umpqua River for the purpose of developing electricity. The cost of the plant is estimated at $30,000.

CHICO, CAL.—The Board of Trustees has under consideration a plan for the installation of electroliers in the business section of the city.

EUREKA, CAL.—Additional generators are being installed at the power plant of the Western States Gas & Electric Company to furnish power for gold dredging in the vicinity of Junction City.

FORT BIDWELL, CAL.—The Bidwell Electric Company has been organized by W. D. Hill and I. H. Skillman with the intention of furnishing energy for light and power to the Bidwell East, Bidwell West and Lake City precincts of Modoc County.

FRESNO, CAL.—Both transmission lines of the San Joaquin Light & Power Company from Crane Valley to Fresno were broken by last week's storm, and one power pole near Wilburn was destroyed by lightning.

LOS ANGELES, CAL.—The Supervisors will receive bids up to October 9 for the installation of an addition to the street-lighting system in the Lankershim lighting district.

LOS ANGELES, CAL.—The California-Arizona Construction Company has been awarded the contract for the installation of concrete lighting posts on West Adams Street at $21,539.

LOS ANGELES, CAL.—A petition has been received by the City Council from property owners on Cherokee Street and Leland Way in Hollywood asking for the installation of ornamental lights.

OROVILLE, CAL.—Lightning struck the lightning-arrester house at the Coal Canyon powerhouse of the Oro Electric Corporation a few days ago, setting it on fire and destroying it to such an extent that the lighting system was put out of commission entirely.

REDDING, CAL.—The Northern California Power Company has purchased the 1,100-acre ranch of T. H. Benton on Battle Creek, which carries with it three important water rights from Digger Creek, Bailey Creek and Battle Creek.

SAN FRANCISCO, CAL.—The General Electric Company has been awarded the contract for furnishing electric switchboards for the Hetch-Hetchy project on its bid of $2,849.

SAN FRANCISCO, CAL.—The new lighting system on Market Street was given a trial a few nights ago, in preparation for the celebration this week to commemorate its installation.

SAUSALITO, CAL.—The Sausalito Gas Company has been incorporated to construct a gas and electric plant at Sausalito. The company is capitalized at $100,000, and its directors are D. R. Caldwell, J. E. Bell, W. B. Flint, T. H. Groah and F. G. Horseman.

VISALIA, CAL.—The Town Trustees have taken steps toward the installation of an electrolier lighting system in the business section of the city. A committee has been appointed to investigate the cost and other details of the proposed improvement.

WOODLAND, CAL.—The Yolo Water & Power Company has won its suit to condemn about 76 acres of land on Clear Lake, Lake County. The defendants claimed that the lands not taken would be damaged $40,000 by reason of the raising of Clear Lake, but the jury allowed them nothing.

Proposals

ENGINE.—Bids will be received until October 18 at South Jacksonville, Fla., by the Board of Bond Trustees for an engine for the electric-lighting and water plant.

ELECTRICAL EQUIPMENT.—Bids will be received until 2 p. m., October 12, at Yosemite, Cal., for hydroelectric equipment for Yosemite Park, including waterwheels, generators, transformers and switchboards. Inquiries should be addressed to Galloway & Markwart, First National Bank Building, San Francisco, Cal.

LIGHTING EQUIPMENT.—The New York Municipal Railway Corporation invites proposals for the installation of tunnel and station lighting equipment, etc., Broadway Subway, Manhattan, bids opened October 16. Plans and further information can be obtained from the chief engineer, 85 Clinton Street, Brooklyn, N. Y.

POWER PLANT.—Sealed bids will be received by the Board of Administration, Capitol Building, Springfield, Ill., October 10, for all labor and material necessary, and to furnish and install the main switchboard, generator and exciter, wiring connections, transformers, etc., and accessories in power house at the Chicago State Hospital at Dunning, Ill. Plans and specifications may be obtained by application to Martin C. Schwab, consulting engineer, 1514 Mallers Building, Chicago, Ill. The Board of Administration reserves the right to reject any and all bids. Frank D. Whipp, Fiscal Supervisor.

TELEPHONE SUPPLIES.—Sealed proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until October 13, under Proposal 853, for furnishing 100 receivers, 50 ringers, 100 screw plugs, 100 caps, 100 rings, 50 slides, 25 generators, 250 plugs, 200 cups, 450 condensers, 500 diaphragms, 10,000 carbide charges, 27 generators, 104 transmitters, 136 cross-connecting blocks, hand set telephones, telephone head-sets, retardation coils and mountings, gun telephones and condensers. For further information address Major Charles S. Wallace, Signal Corps, U. S. Army.

ELECTRICAL MATERIAL.—Sealed bids will be received by the Metropolitan Water District of Omaha, Neb., October 11, for furnishing certain materials, tools, apparatus, labor and all other essentials necessary for the construction of the following specified work: (a) Service lines, including underground cables, extending from and connecting with the electric wires of the Omaha Electric Light & Power Company on Nicholas Street, near Thirty-ninth Street, and connecting with the switchboard to be located in the building now in process of construction at Thirty-ninth Street and Lafayette Avenue. (b) Interior wiring, conduits, fixtures, lamps and sundry equipment, to be installed in main building and addition. (c) Exterior wiring, underground conduits, fixtures, lamps and sundry equipment, to be installed in and about the walks, grounds and steps at the Walnut Hill Station. All the above described work shall be in accordance with the plans and specification on file in the office of R. B. Howell, General Manager.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 197, Newport, R. I., 100 electric soldering irons. Schedule 199, Annapolis, Md., one dynamometer. Schedule 203, Newport, R. I., 300 pounds of clear, uncut mica, 40,000 feet of ebonite tubing, and 15,000 feet of iridium platinum wire. Schedule 210, Washington, D. C., 225 condulet ells, 10,350 lock nuts for conduits, 500 pounds of wire solder, and miscellaneous outlet and junction boxes. Schedule 210, Boston, Mass., 255 pounds of hard sheet rubber, and miscellaneous push buttons, link fuses and fuse wire. Schedule 210, Philadelphia, Pa., 30 disk-type electric heaters, eight sets of 36-inch searchlight strips, and miscellaneous push buttons, plug fuses and testing generators Schedule 210, Norfolk, Va., 25 firing salvo buzzers, and miscellaneous link fuses, plug fuses, fuse wire and resistance wire. Schedule 210, Brooklyn, N. Y., 1,250 assembled caps complete with pivot and chain, 40 mangin and parabolic searchlight mirrors, and miscellaneous testing generators. Schedule 210, Mare Island, Cal., miscellaneous plate carbon. Schedule 210, various navy yards, 11,500 portable guards, and miscellaneous annunciators vibrating bells and buzzers, brass and steel conduit, sheet and rod fiber, electric flatirons, refillable inclosed fuses, glass-tube fuses, electric soldering irons, uncut mica, attachment plugs, portable ventilating sets, switches, fuse wire and magnet wire. Bidders desiring to submit proposals should make application immediately for schedules to the Bureau, or to the purchasing office nearest to navy yard where delivery is to be made.

Financial Notes

Directors of the Westinghouse Electric & Manufacturing Company adopted a resolution calling for the payment on January 1 of all the outstanding five-per-cent convertible bonds of the issue of 1915 at 105 and interest. The bonds are convertible to the end of this year, par for par, in common stock.

The net income or profits of the Eastern Oregon Light & Power Company for the year ending June 30 totaled $21,659.10. Net operating revenues were $198,544.78, operating expenses $84,081.81, and net operating revenues $114,462.97. The surplus at the beginning of the fiscal year was $143,480.10, and to this was added $13,187.87 June 30.

In the hearing before the California Railroad Commission on the Great Western Water Power Company's application to use the proceeds derived from the sale of City Electric Company stock for reimbursement of the treasury and for approval to operate the Consolidated Electric Company's property in Oakland, and the City Electric Company's property in San Francisco, much discussion was given over to the financial condition and depreciation of Great Western Power. According to President Fleishhacker, the surplus for the whole system is $2,000,000.

The reorganization plans of the $8,500,000 Northern Electric Railway Company, now in the hands of a receiver, are being considered by the California Railroad Commission. The plan proposes the formation of a new company. This concern intends to issue $500,000 of first-mortgage bonds to meet reorganization expenses, $5,500,000 in general-mortgage bonds to care for the mortgages and bonds of the first Northern Electric Company and other underlying issues, and income bonds totaling $10,000,000 to pay off the bonds and mortgages and the unsecured creditors of the Northern Electric Railway Company. Stock valued at $2,000,000 will be issued by the new company. The line has been in a financial tangle for some time, and in receivership for two years. The company, valued at $8,500,000 by the Commission, operates 163 miles of track, connecting Sacramento, Marysville, Chico, Colusa, Oroville and other valley cities.

With the depositing of more than 75 per cent of both preferred and common stocks

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Oct. 2	Sept. 25
American Tel. & Tel. (New York)	133½	133
Commonwealth Edison (Chicago)	145½	145½
Edison Electric Illuminating (Boston)	235	240
Electric Storage Battery common (Philadelphia)	71¼	71½
Electric Storage Battery preferred (Philadelphia)	71½	71½
General Electric (New York)	181½	174½
Kings County Electric (New York)	130	130
Massachusetts Electric common (Boston)	5¾	5½
Massachusetts Electric preferred (Boston)	35¼	36
National Carbon common (Chicago)	215	190
National Carbon preferred (Chicago)	...	...
New England Telephone (Boston)	127¼	129
Philadelphia Electric (Philadelphia)	28¼	28⅜
Postal Telegraph and Cables common (New York)	85	85½
Postal Telegraph and Cables preferred (New York)	66½	66⅝
Western Union (New York)	100½	101¼
Westinghouse common (New York)	64½	63⅞
Westinghouse preferred (New York)	72	72

of Toledo Traction, Light & Power Company, the plan for the exchange of Toledo preferred share for share for Cities Service preferred and seven per cent of Cities Service common and 35 per cent of Cities Service preferred has become effective, and the exchange of stock will be made at once. The first dividends on the exchanged stock will be paid November 1. With the acquiring of the Toledo Traction, Light & Power Company, the rapidly increasing earnings of this company will show on Cities Service balance sheet, and will also add about 2,000 individual stockholders to the latter company.

Alexander Brown & Sons, of Baltimore, announce that financial plans have been completed which contemplate the retirement at 120 of the preferred stock of the Consolidated Gas, Electric Light & Power Company of Baltimore. In this connection, Alexander Brown & Sons, in conjunction with Brown Brothers & Company, Lee, Higginson & Company and Jackson & Curtis, have completed arrangements with the Consolidated Gas, Electric Light & Power Company for a more comprehensive financial plan than the one recently suggested by the company. The latter plan, therefore, will be abandoned, the preferred stock retired, and new rights issued to common stockholders. Details of the new plan will be announced later.

Dividends.

	Term	Rate	Payable	
Asso. Gas & Elec., pf	Q	1.5 %	Oct.	16
Bell Tel. of Pa	Q	1.5 %	Oct.	16
Boston Sub. Elec., pf	Q	50c	Oct.	14
Cal. Ry. & Pw., prior pf.	Q	1 %	Oct.	2
Con. Westinghouse	Q	1.75%	Oct.	10
Cent. & So. Am. Teleg.	Q	1.5 %	Oct.	9
Cin., Newport & Cov. Lt. & Trac., pf	Q	1.25%	Oct.	15
Cin., Newport & Cov. Lt. & Trac., com	Q	1.5 %	Oct.	15
Commonwealth Gas & Elec., pf	Q	1.5 %	Oct.	16
Detroit Edison	Q	2. %	Oct.	16
Detroit United Rys	Q	1.75%	Dec.	1
East. Shore Gas & El., pf.	Q	1.5 %	Sept.	27
Elec., Sec., pf	Q	1.25%	Nov.	1
Gen. Gas & El. (accum.)—		1.75%	Oct.	7
Marlborough Elec	Q	2.5 %	Oct.	10
Mexican Teleg	Q	2.5 %	Oct.	16
Nat'l Carbon, com	Q	2 %	Oct.	14
Nat'l Carbon, pf	Q	1.75%	Nov.	15
N. E. Power, pf	Q	1.5 %	Oct.	14
No. States Power, com.	Q	1.5 %	Oct.	20
No. States Power, pf.	Q	1.75%	Oct.	15
Old Colony Lt. & Pw., pf.	Q	1.5 %	Oct.	2
Penn Cent. Lt. & Pw., pf	Q	1 %	Oct.	2
Pitts. & W., pf	Q	1.25%	Oct.	14
Pub. Serv. Corp., No. Ill., com	Q	1.75%	Nov.	1
Pub. Serv. Corp., No. Ill., pf	Q	1.5 %	Nov.	1
United Rys. & Elec., com	Q	50c	Oct.	14
West Kootenay Pw., pf.	Q	1.75%	Oct.	2
West Kootenay Pw., com	Q	1.25%	Oct.	2
West Penn Pw., pf.	Q	1.75%	Nov.	1
West Penn Rys., pf.	Q	1.25%	Nov.	1
West Penn Trac., pf.	Q	1.5 %	Oct.	16
West. E. & M.	Q	75c	Oct.	16
West. E. & M., pf.	Q	87.5c	Oct.	16

Reports of Earnings.

AMERICAN WATER WORKS & ELECTRIC COMPANY.

The American Water Works & Electric Company has issued its report for the year ended June 30, 1916. Income account compares as follows:

	1916	1915
Company's proportion of subsidiary companies' earnings	†$ 653,156	$ 646,013
Income from bonds, stocks, etc.	713,654	348,463
Total income	1,366,811	994,475
Expenses and taxes	67,719	48,354
Net earnings	1,299,091	946,122
Interest charges, etc.	789,958	467,484
Net income	509,133	478,638
Funds set aside under t.e r m s supplemental mortgage	337,445	519,455
Surplus	171,688	*40,817

†Shreveport plant earnings not included for 1916.
*Deficit.

UNITED LIGHT & RAILWAYS.

United Light & Railways reported combined earnings of subsidiaries, for 12 months ended August 31, as follows:

	1916	1915
Gross	$6,736,188	$6,153,757
Net after taxes	2,676,829	2,382,055
Surplus after charges	1,277,711	1,024,499

United Light & Railways Co. reported earnings for the 12 months from all sources:

	1916	1915
Total income	$1,850,435	$1,522,865
Expenses	140,901	118,110
Fixed charges	559,990	486,762
Amortization	5,015	12,912
Net income	1,144,528	905,082
First preferred dividends	592,516	483,745
Second preferred dividends	.....	52,717
Surplus	552,012	368,619

New Incorporations

CHICAGO, ILL.—L. B. Lincoln Electric Works has increased its capital stock from $50,000 to $600,000.

DETROIT, MICH.—United Electric Service Company. Capital, $20,000. Incorporators: S. C. Aikenhead, P. W. Chute and J. G. Harks.

DAYTON, O.—The U. B. Light, Heat & Power Company. Capital, $10,000. Incorporators: A. W. Drury, H. C. Cridland, W. R. Funk, R. C. Kumler and F. A. Z. Kumler.

NEW YORK, N. Y.—Triangle Electric Trading Company. Capital, $5,000. Incorporators: D. L. Graff and B. Berwick, 1629 Madison Avenue, and James Male, 111 West 118th Street.

EAST ORANGE, N. J.—Electric Rectifier Company. Capital, $100,000. Manufacture electrical apparatus. Incorporators: Robert A. Bachman, James M. Clark and Daniel T. Dubyns.

ALBANY, N. Y.—Rathbone-Sard Electric Company. Capital, $50,000. Manufacture electrical appliances and devices, electric stoves, ranges, bake ovens, cooking utensils, etc. Incorporators: A. M. Blanchard, H. P. G. Norstrand and R. E. Sard.

NEW YORK, N. Y.—Alfred Whiteley, Inc. Capital, $5,000. Electrical jobbing business. Incorporators: Alfred Whiteley, Port Richmond; B. G. Anderson, 84 John Street, New York City, and Charles Winkelhaus, 493 Evergreen Avenue, Brooklyn.

NEW YORK, N. Y.—vital Utilities Corporation. Capital, $25,000. Manufacture electrical household devices. Incorporators: John F. Walsh and M. J. Walsh, 364 East 198th Street, New York City, and J. J. Walsh, Brooklyn.

WILMINGTON, DEL.—Interior Telephone Securities Company. Capital, $1,000,000. Public utility investments and securities. Incorporators: Herbert E. Latter and Norman P. Coffin, Wilmington, and Clement M. Egner, Elkton, Md.

ESOPUS, N. Y.—O'Connor Electric Company. Capital, $5,000. Manufacture electrical apparatus. Incorporators: James O'Connor, 626 West End Avenue, New York City; Arthur Conrow, 2441 Seventh Avenue, New York City, and S. A. O'Neill, 1839 Westchester Avenue, Bronx.

Electrical Patents Issued September 26, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,199,041. Process of Treating Certain Aluminous Abrasives. T. B. Allen, assignor to General Abrasive Co., Niagara Falls, N. Y. Process of treating artificially prepared aluminous abrasives containing iron, silicon and titanium as impurities.

1,199,042. Manufacture of Crystallized Abrasives. T. B. Allen, assignor to General Abrasive Co. Comprises fusing alumina in an electric furnace.

1,199,046. Automatic Relay for Electric Regulators. W. L. Bliss, assignor to U. S. Light & Heat Corp., Niagara Falls, N. Y. Electromagnetically operated compression resistance.

1,199,050. Fire Alarm. C. J. Cid, Quebec, Canada. Details of box having battery bell and lamp supplied by outside current.

1,199,071. Non-Glaring Headlight. M. L. Heckert, Mount Carmel, Pa. Parabolic reflector constructed to reflect downwardly from both upper and lower halves.

1,199,072. Globe and Shade Holder. W. C. Homan, assignor to Edward Miller & Co., Meriden, Conn. Details of device having globe-gripping spring-ring.

1,199,086. Induction Transformer. J. Laufer, assignor to Siemens-Schuckertwerke, G. M. B. H., Siemenstadt, Germany. Rotor is disengaged from adjusting mechanism on excessive torque.

1,199,092. Electric Transformer and Welding, Smelting and Like Apparatus. R. Mack, Neu Templehof, Berlin, Germany. Single-phase, low-tension transformer.

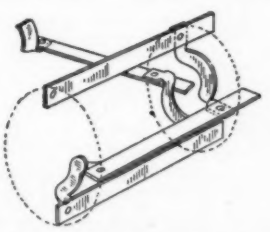
1,199,097. Electric-Motor Armature Winding and Method of Applying the Same. T. M. Mueller, assignor to Maximum Electrical Co., Detroit, Mich. Flat, thin, axial bars are end-connected by flat, circumferential segments twisted into planes transverse to the bars. (See cut.)

1,199,138. Headlight Reflector. E. G. Wiederholdt, St. Louis, Mo. Upper portion reflects forwardly and downwardly and lower half reflects onto upper half.

1,199,145. Device for Testing Working of Magnetos, Etc. C. S. Zink, Marshall, Mo. Details of device having visible spark-gaps.

1,199,150. Method for Adjusting Electric Meters. O. T. Blathy, Budapest, Austria, Hungary. Scheme for comparing rotary parts corresponding to standard and tested meters.

1,199,156. Automatic Telephone Trunking System. W. L. Campbell, assignor to Automatic Electric Co., Chicago, Ill. Insertion of plug in jack causes selector to seize idle trunk and select another trunk for the next call.



No. 1,199,097.—Electric-Motor Armature Winding and Method of Applying Same.

1,199,158. Call-Distributing Telephone System. H. P. Clausen, assignor to Western Electric Co., New York, N. Y. Automatic means for connecting subscribers' lines with idle trunks.

1,199,172. Swivel for Electrical Conductors. F. Garrison, St. Louis, Mo. Has two relatively rotatable parts with sliding contacts permitting rotation.

1,199,180. System for the Transmission of Intelligence. R. A. Heising, assignor to Western Electric Co. Radio transmission system employing thermionic repeater.

1,199,199. Electrically Controlled Hood-Lock. H. L. Mason, Kansas City, Mo., assignor to Universal Safety Lock Co. Solenoid-operated bolt.

1,199,210. Electric-Lighting System for Automobiles. H. W. Shryock, Everson, Wash. Arrangement of magneto resistance, switch, etc.

1,199,212. Apparatus for Distributing Electric Current. F. M. Simpson, Montreal, Quebec, Canada. Supporting bracket for clamping about pole. (See cut, next page.)

1,199,213. Transmitting Apparatus for Wireless Telegraph Stations. F. G. Simpson, Seattle, Wash. Special arrangement of trigger and oscillation circuits.

1,199,226. Automobile-Theft Alarm. H. B. Alexander, St. Louis, Mo. Switch may be moved and locked in position to be actuated if vehicle is moved.

1,199,239. Internal-Combustion Engine. C. M. Buck, San Leandro, Cal. Details of distributer driving clutch.

1,199,253. Automatic Electric Water-Purifier. G. E. Erickson, New York, N. Y. Structural details of electrolytic device.

1,199,262. Telegraphic Transmission. J. Gell, London, England. Messages impressed on line at high speed are divided for transcription at lower speed.

1,199,276. Flashlight. M. L. Kaplan, assignor to Beacon Miniature Electric Co., New York, N. Y. Details of usual tubular, battery device.

1,199,281. Fusing Apparatus for Dental Casting. L. H. Lanier, Cordell, Okla. One electrode is hand implement and other is carbon crucible fitted to mold.

1,199,282 and 1,199,283. Trolley Mechanism. N. D. Levin, assignor to Jeffery Manufacturing Co., Columbus, O. First patent: Trolley arm and mounting mechanism for mine locomotives. Second patent: Modification.

1,199,298. Electrically Operated Valve. F. W. Obenhaus, Pasadena, Cal. Details of valve structure, including electromagnet.

1,199,317. Semi-Automatic Trunking System. J. A. Taggart, assignor to Strom-

berg-Carlson Telephone Mfg. Co., Rochester, N. Y. Details of selective trunking switch.

1,199,326. Attachable Support for Electric Lamps. L. Weil, Cleveland, O. For attachment to table edge, etc.

1,199,338 and 1,199,339. Telegraph System. J. H. Bell, assignor to Western Electric Co. First patent: Repeating system. Second patent: Has line relays to prevent interfering of operation of transmitters.

1,199,340. Compartment or Bulkhead Leaking Indicator for Ships and the Like. G. Bloch, Milwaukee, Wis. Details of device having electric lamps and indicator arms.

1,199,341. Method of and Means for Energizing Electric Generator. G. Bluemel, Chicago, Ill., assignor of one-half to W. M. Simpson, Chicago, Ill. Arrangement of generator and exciter.

1,199,342. Automatic Electric Crossing-Gate. J. Briggs, Hoopeston, Ill. Adapted for operation with a track having a block signal.

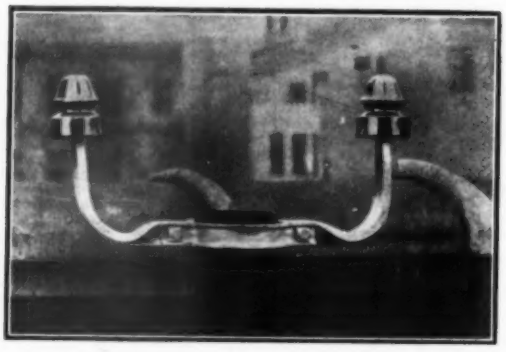
1,199,348. Cutout Block. R. C. Cole, assignor to Johns-Pratt Co., Hartford, Conn. Structural details of fuse block.

1,199,349. High-Tension Telegraph-Circuit Protector. R. C. Cole, assignor to Johns-Pratt Co. Combined lightning arrester and fuse.

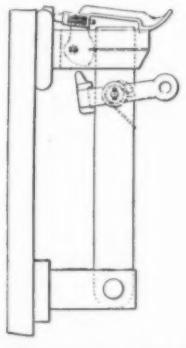
1,199,388. Electric Speed Signal. J. B. Kimpflin, Akron, O. Governor causes successive lighting of indicator lamps.

1,199,390. Dry-Battery. A. Landau, assignor to United Battery Corp., Brooklyn, N. Y. Manner of inclosing a zinc container.

1,199,392. Pen Flashlight. W. Lenzikow and D. Buhler, New York, N. Y. Battery in cap and lamp on arm foldable close to side of pen.



No. 1,199,212.—Apparatus for Distributing Electric Current.



No. 1,199,451.—Latching Device for Knife-Switches.

1,199,407. Last Lathe. C. P. Morton, Cincinnati, O. Mounting, etc., of motor-driven cutter heads.

1,199,426. Heater for Molds. J. M. Roth, Pittsburgh, Pa. Iron core-rod electrically heated to weld with non-ferrous metal poured about it.

1,199,428. Electrically Heated Mold. J. M. Roth, Pittsburgh, Pa. Sheath cast on metal core in mold of electrically heated resistance material, welding the metals together.

1,199,444. Electrical Measuring Instrument. T. W. Varley, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Employs rotating thermoelectric couples.

1,199,447. Electromagnet. R. Wikander, assignor to Westinghouse Electric & Mfg. Co. Structural details of switch-operating magnet.

1,199,451. Latching Device for Knife-Switches. G. L. Christman and H. Baxter, assignors to Westinghouse Electric & Mfg. Co. For releasably holding blade in closed position. (See cut.)

1,199,453. System and Method of Controlling Electric Motors. J. L. Davis, assignor to Westinghouse Electric & Mfg. Co. Method of controlling motor having divided armature and field windings.

1,199,457. Process for Producing Jelly. J. S. Ellithorp, Jr., Palatine Bridge, N. Y. Fruit juice containing pectin is subjected to current.

1,199,459. Dirt Collector for Rectifiers. S. W. Farnsworth, assignor to Westinghouse Electric & Mfg. Co. Electrode of mercury vapor rectifier has arc supporting portion connected with inactive pool.

1,199,466. Iron Porcelain Insulating Support. R. P. Jackson, assignor to Westinghouse Electric & Mfg. Co. Nested conducting members separated by insulating members.

1,199,467. Iron Porcelain Insulating Bushing. R. P. Jackson, assignor to Westinghouse Electric & Mfg. Co. Modification of above.

1,199,468 and 1,199,469. Mechanical Rectifier. R. P. Jackson, assignor to Westinghouse Electric & Mfg. Co. Special resistance is intermittently included in circuit to oppose undesired current waves.

1,199,472. Electrolytic Apparatus. I. H. Levin, Newark, N. J. Series of cells have common ducts for electrolyte, etc., and passage of current through ducts is prevented.

1,199,477. Circuit-Interrupter. J. N. Mahoney, assignor to Westinghouse Electric & Mfg. Co. Manner of controlling pressure in oil switches.

1,199,478. Contact Member. J. N. Mahoney, assignor to Westinghouse Electric & Mfg. Co. Special structure of main and arcing contacts in current-interrupter.

1,199,050. Fire Alarm. C. J. Cid, Quebec, wood, Wheeling, W. Va. Suspension device for light-inclosing bowl and reflector above bowl.

1,199,494. Arrangement for Producing Short Unidirected High-Tension Current Impulses. A. Pfeifer, assignor to Electricitatsgeselischaft "Sanitas" M. B. H., Berlin, Germany. Comprises a generator, the serviceable portion of whose waves is a fraction of the periodic time, having its field excited by alternating current, transformer, switch, etc.

1,199,511. Ignition Dynamo. H. R. Van Deventer, assignor to Splitdorf Electrical Co., Newark, N. J. Make and break spark electrodes connected with magneto to operate in predetermined relation to current wave.

1.199.518. Socket Cover with Interchangeable Shade Support. I. W. Anderson, Waterbury, Conn. Shade holder is screw-threaded on casing covering lamp socket.

1,199,534. Signal-Indicating and Light-Dimming Means. J. F. Ernst, Minneapolis, Minn. Pneumatic sack may be distended at will to cover lens of headlight.

1,199,537. Electric Welding Transformer. E. Fulda, New York, N. Y. Pair of concentrically mounted roller electrodes are secondary terminals of transformers mounted on the rollers.

1,199,539. Ignition Testing Apparatus. A. Fulton, Western Springs, Ill. Details of device having visible gap for plug testing.

1,199,540. Spark-Plug. F. M. Furber, Revere, Mass. Special manner of securing insulator in casing.

1,199,541. Spark-Plug and Method of Manufacturing Spark-Plugs. F. M. Furber. Related to above.

1,199,545. Indicating Signal for Vehicles. W. P. Hammond, Passaic, N. J. Direction indicator.

1,199,558. Zinc Electrode for Gravity Batteries. L. R. Jones, Camden, N. J. Manner of supporting zinc bodies.

1,199,560. Automobile Signal. W. E. Jones, St. Louis, Mo. Direction indicator; restored by straight-away position of steering wheel.

1,199,571. Electric Load-Distributer. J. E. King, assignor of one-half to W. C. Pearce, Syracuse, N. Y. Demand on main supply is kept constant by varying auxiliary supply to compensate for varying load on system.

1,199,578. Shutter-Adjusting Mechanism for Vehicle Lamps. P. Latta, Dallas, Tex. Details of device for automobile headlights.

1,199,582. Metal Burner and Welder. P. Lynch, Rock Island, Ill. Portable electric welding appliance.

1,199,587. Sectional Support for Pendent Light-Fixtures. A. H. Manwaring, Philadelphia, Pa. Bowl support of sheet-metal, hollow, telescoping sections.

1,199,588. Electromechanical Switch-Lock and Indicator. J. W. Mark, New York, N. Y. Knife switch interlocked with oil switch.

1,199,620. Rail Bond. E. L. Shain, Crown Hill, W. Va. Bond extends between clamps on rail flanges.

1,199,638. Burglar-Alarm Lock. A. W. F. Viehweger, Hoboken, N. J. Contacts in door lock are closed on attempted operation by improper key.

1,199,642. Apparatus for the Sterilization of Fluids. W. R. Walkey, Westminster, London, England. Comprises source of ultra-violet light.

1,199,652. Electric Motor. L. J. Aron and C. E. Harrison, assignors to X. L. Electric Co., London, England. Special structure of rotor and field-poles.

1,199,654. Circuit-Closer for Fire-Alarm Systems. F. R. Bailey, Manzanola, Colo. Fuses ignite powder charges which force contacts together.

1,199,669. Trolley-Pole. E. J. Dacey, Eriton, Pa. Manner of mounting harp on pole.

1,199,699. Electromagnetic Signaling Apparatus. G. Henderson, South Porcupine, Ontario, Canada. Details of electromagnetic gong.

1,199,710. Signaling Device. W. J. Newton, assignor of one-half to E. L. Allen, King County, Wash. Small lamps on fingers of operator have lighting controlled by movement of fingers.

1,199,724. Electrical Measuring Apparatus. F. Wunsch, assignor to Leeds & Northrup Co., Philadelphia, Pa. Combination of thermo-couple and potentiometer.

1,199,731. Medical Appliance. R. Ilgner Elbing, assignor to G. Wolf, G. M. B. H., Berlin, Germany. Lighting of hysteroscope.

1,199,735. Insulator Pin. J. W. Porter, assignor to Electric Service Supplies Co., Philadelphia, Pa. Details of device for bolting to cross arm.

1,199,741. Grid for Secondary Batteries. A. B. Deike, assignor of one-half to F. E. Mathews, Cleveland, O. For supporting oxid filling.

1,199,748. Automatic and Manual Telephone System. T. G. Martin, assignor to Automatic Electric Co., Chicago, Ill. For interconnecting local-battery manual subscribers' lines and common-battery automatic subscribers' lines.

PATENTS EXPIRED.

The following United States electrical patents expired October 3, 1916:

634,023. Electric Signal for Railways. T. H. Patenall, Easton, Pa.

634,057. Electric Switch. W. Ely, Providence, R. I.

634,085. Electric Arc Lamp. A. Hamacek, Sturgeon Bay, Mich.

634,095. Electric Annunciator. C. E. Scribner, Chicago, Ill.

634,118. Danger-Signal System. W. Mayes, Omaha, Neb.

634,157. Electric Arc Lamp. J. M. Willard, Decatur, Ill.

634,165. Portable Electrical Drilling Machine. A. L. Croneau, Paris, France.

634,169. Flexible Electrical Conduit or Tube. E. T. Greenfield, New York, N. Y.

634,187. Railway Signal. J. Sargent, Rochester, N. Y.

634,198. Method of and Means for Preventing Electric Sparking. C. L. Buckington and E. Germann, New York N. Y.

634,220. Electric Signaling Apparatus for Elevators. J. B. Smalley and C. A. Reiners, Chicago, Ill.

634,226. Electric Switch or Signal Apparatus. F. Andrews, Chicago, Ill.

634,227. Electric Signaling Device for Elevators. C. G. Armstrong, Chicago, Ill.

634,229. Electric Signaling Apparatus for Elevators. S. D. Collett, New York, N. Y.

634,231. Electric Belt. L. A. Dixon, Marshall, Mich.

634,258. System for Power Transmission for Electric Traction. E. Bede, Brussels, Belgium.

634,286. Electric-Lighting System for Cars. J. L. Creveling, New York, N. Y.

634,295. Reflector for Incandescent Lamps. W. Goodchild, Wyoming, N. J.

634,314. Electric Arc Lamp. C. Tepel, Bennett, Pa.

634,315. Electric Seam-Calking Tool. E. T. Thomas, New York, N. Y.

634,316. Sign. C. C. Whelan, Washington, D. C.

634,356. Electromagneto Apparatus for Separating Ores. E. Kreuser, Mechernich, Germany.

634,381. Junction Box for Manholes. J. W. Turner, New Orleans, La.

634,388. Railway Signal. W. S. Boult, London, England.

634,403. Electrical Apparatus for Exhibiting and Changing Advertisements, Signs, or the Like. A. D. Douglas, London, England.

634,430. Electric Igniter for Gas Engines. W. H. Cotton, Chicago, Ill.